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JOURNAL OF ELECTRICITY

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HERBERT HOOVER

the one man best able to serve human society during the critical period of readjustment now upon us

Whether the call be to the presidency of the United States, to the chairmanship of the League of Nations, or to continue in a private capacity as an earnest student of economic problems, the fact remains that the mellowing influence of the human sympathy of this man, combined with his world grasp of economic problems possessed by no other living individual, may well be said to hold in promise a rich blessing for our nation. That our great West should have produced this man must bespeak the molding of character and vision possible in this land, where men breathe ideals as big as the expanse of country wherein they live.

FEB -9 1920

JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Vol. 44 SAN FRANCISCO, FEBRUARY 1, 1920 No. 3

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HOOVER FOR PRESIDENT

THERE is a certain underlying conviction running through the minds of the nation today that is asserting itself in a spontaneous burst of expression on all sides. Citizens are awakening from the tense stress of war to find a status of peace only possible under the firm direction of a quantitative mind, fully familiar with the vast economic necessities of the peoples of the world, and yet withal only possible under the vigilant direction of a mind ruled by a heart sympathetic with the world and its peoples in their present distressing dilemma.

We ask ourselves, has indeed the great war been fought, and has indeed the great world gone through its awful suffering only again to awaken to a day of pre-war conditions and pre-war atmosphere, with its old envyings, its old jealousies, and its old channels of approach to vast problems awaiting solution, still obstructed with imperfect vision?

Engineers the country over are profoundly impressed with the possibilities of an engineer president for 1920 — the first since the days of Washington. We of the West know and love Herbert Hoover, as a graduate of Stanford University, as a fellow member of the San Francisco Engineers' Club, and of many of our other professional and intellectual institutions of the West.

But while we are profoundly impressed with the fact that Herbert Hoover is a man of international reputation as an Engineer and that he portrays to the world at large a personification of the highest ideals of the West, yet it is to Herbert Hoover, the sympathetic master mind in the overcoming of the great tragedy of the war—the feeding of countless millions, and the economic rehabilitation of the world's transportation and economic channels immediately after its cessation — we look for the enthusiasm, the inspiration, and the vision to carry us through.

The Importance of Electrical Tests for Vacuum Valves

Experiences of the war have brought out the fact that by careful checking and testing, and drawing correct conclusions it is possible to manufacture machine made vacuum valves so that each valve will not only be like its fellow in physical appearance but in electrical characteristics as well. Such tests have proven that the machine made valve with its mechanically formed elements is possible of production so that more uniform results are possible than with the hand made valve. The outstanding feature of this uniformity is found to be in the fact that the single operation of machine forming retains its shape better under the subsequent heat treatment.

On another page of this issue may be found interesting tests on this subject by Captain R. W. A. Brewer, who acted as inspector for the British government during the war period in the manufacture of large quantities of vacuum valves produced in San Francisco, California.

In the article referred to, the vacuum valve is discussed with reference to its application as an amplifier of radio signals, and stress is laid upon the desirability of obtaining audible rather than intense sound.

The priciples governing the operation of thermionic currents are touched upon and the reasons why a "hard" or high vacuum valve is more suitable than a soft or gas filled valve. The effect of ionization in a soft valve is discussed and the method adopted for counteracting its effect is explained. Detailed dimensions are given of a standard form of French valve and the performance of this type of valve on some tests is shown by figures and graphs.

Methods are shown of making certain tests to ascertain the correct placing of the elements on the valve. The electronic generation and flow are indicated graphically with regard to the function of filament current and anode potential.

Saturation is discussed and graphically indicated, as also is the effect of drop of plate potential with increase of electronic flow or decrease of valve resistance.

The conclusions to be drawn from this article are that a uniform product of this delicate nature

can be produced commercially provided that careful attention is given to the details. That when close inspection is carried out the hard valve will function uniformly when it has passed the prescribed major tests.

The Publisher and the New Year

The spirit of optimism that pervades industry throughout the Nation, is well reflected in the New Year's letter which has recently been sent out by James H. McGraw, president of the McGraw-Hill Company, publishers of the Journal of Electricity and its ten companion engineering papers.

The trials of the past three months that came into the life of most publishers of national periodicals are well known to the public generally, and as a consequence excerpts from this message breathe to industry at large a message that is timely and helpful:

"Despite all the turmoil which we have been through during the year, I approach the New Year in a spirit of optimism. The worst, I believe, is over. There are still difficulties ahead, but the world is settling down to work, and with increased production and the sobering influence of earnest work will come that peace of mind which the world so sorely needs. Except for its salutary lessons, let us forget the year 1919 and turn the new hope to the new year that is dawning.

"It can, and should be a wonderful year. With a shortage in all lines, which means abundant work for all, there should be great prosperity. In the resulting reconstruction the McGraw-Hill Engineering Publications should play an increasingly important part. We serve the country's fundamental industries. To live up to our opportunity and to become more and more effective, each one's thinking must be quickened and the highest intelligence applied to each and every task.

"I have spoken before of my hope that all of our work will become of "Tiffany" quality. We should be satisfied with nothing less. May I ask each of you to work to that standard during the coming year? Let us make the service of our publications above criticism. Then shall we receive the reward which the world ungrudgingly gives to excellence."

Electricity in the Shipping Industry

The application of electricity in the shipping industry has received great impetus upon the Pacific Coast. Especially in the development of the electric propulsion of ships has this region held a prominent place. The collier "Jupiter," first of the electrically-driven ships of the navy, was constructed at Mare Island Navy Yard, and recently there was launched at that station the dreadnaught "California," electrically propelled and electrically equipped throughout, a capital ship of 32,000 tons displacement. The mighty flagship of the Pacific Fleet that guards our coastline is the famous "New Mexico," equipped in manner almost identical to the "California."

Nor is this electric propulsion to be applied only to ships of war. Commercial shipbuilders perceive the immense advantages of this modern method, and authoritative reports are to the effect that they are preparing to install turbo-electric drive on a considerable number of steel and wooden ships to be built within the year at Pacific Coast shipyards.

In the operating and directing of ships, electricity is coming more and more into use on this Coast. New methods in ship-wiring are constantly worked out, and great interest is being manifested in electric arc-welding in the various shipyards. Radio development, so vital now to the activities of the merchant marine, owes much to Western enterprise and invention. In the entire shipping industry the method electrical is steadily gaining ground, and in the present issue of the Journal of Electricity are recorded some of the more recent accomplishments pertaining to this important factor in Pacific Coast progress.

Revising the Gravitational Constant

The recent injection of Einstein's theory into considerations of the constitution of matter in a more definite manner than formerly, due to an observed deflection of rays of light from straight line paths as they pass from stellar bodies beyond the sun toward the earth's surface, has given added interest to a discussion of the fundamental laws upon which the science of engineering is built.

For a number of issues past the Journal of Electricity has been running serially a most important series of articles on the "New Physics," by Dr. A. C. Crehore, formerly of the faculty at Cornell University, a man of international reputation as a physicist and one of our best known authorities on the constitution of matter. On another page of this issue Dr. Crehore has checked up his new theory of matter, taking into account the speed of electrons and using values for his constants derived by experiment that sheds new light on the possible necessity for a revision of the well known gravitational constant used for years by astronomers in their computations relating to problems involved in the study of the planets, comets, meteors and other stellar phenomena.

It will be recalled, according to Newton's great law of gravity, that the force with which mutual attraction is exerted between two bodies is proportional to the product of their masses and indirectly proportional to the square of the distance between their centers of mass. To express this force in numerical values agreeable to our system of absolute units of measurement, it has always been necessary to introduce a constant K^1, known as the gravitational constant, which has a numerical value of 666×10^{-10}. In order that the new theory of matter as developed by Dr. Crehore should prove consistent with accurately established physical constants, this gravitational constant needs to be increased numerically by about five per cent. Since there is more confidence placed in the numerical values of the other constants that enter the equation it seems likely that the gravitational constant must be increased in value over that hitherto given to it.

In engineering practice this modification in value of the gravitational constant would have but small significance. Should recent enunciations prove practical in attempting to fire a projectile to the moon computations involved would, of course, have to be slightly modified. In philosophic reasoning as to the ultimate constitution of matter the question has, however, vast importance. Readers of the Journal of Electricity will, as a consequence, find an unusual treat before them in following succeeding articles that are to appear by Dr. Crehore on the New Physics.

The Ten Commandments in Business

The appearance of a handsomely printed New Year's Greeting entitled, "The Principles of Prosperity," which turned out to be nothing but the recital of the Ten Commandments, has caused considerable comment in the electrical industry throughout the West during recent weeks. Blasphemous, some have pronounced it, while others have apparently been shocked that things sacred in religion should thus be put out to the trade. Frankly put, these were the emotions that came over the editorial staff of the Journal of Electricity before the full meaning of the message was received.

The more we think upon the subject, however, the more appropriate seems to be this method that has been so widely disseminated throughout our industry. Long since the business world has accustomed itself to claim the Golden Rule as the fundamental principle for constructive business building. The great commandments, first enunciated by Moses, while accepted as the underlying ethical standards of modern civilization, have too often been held and cherished at the church meeting and quietly hung in the closet with the Sunday clothes on the Sabbath evening to be laid aside for application until the following Sunday service. The only value that a principle has to humanity and to business is the life practice it enforces upon those who truly and sincerely believe in its demands. Such sincere life practice creates in fact as well as in theory the only true value there is, and as a consequence we endorse most heartily any movement that truly and sincerely is set in motion to put more into daily activity such principles of prosperity as are enunciated in the Ten Commandments.

Astounding Western Development

Perhaps the most prosperous year in all the history of the West, is the verdict of economic experts in commenting upon 1919. Typical of the immense material development which this twelve-month period has seen is the phenomenal growth of the wealth and industry of California, largest of the Western states. The total value of all field crops produced in California in 1919 was $284,483,000; the value of all fruit crops, $234,813,000; of melons and vegetables, $16,200,000. Mineral products for the year amounted to $182,463,000 in value. The total figures for manufacture are not yet available, but are being accurately compiled by the United States Bureau of the Census. It is definitely known that they will far exceed those of any previous year.

Intimately connected with the general trend of prosperity and development, and presaging an even greater expansion in the coming decade, are the figures announced in this issue of the Journal of Electricity by Captain Charles H. Lee, president of the State Water Commission of California. Applications for unappropriated waters during the past year show an increase of nearly 40 per cent over the average for the past five years. During the last six months of 1919, applications were filed contemplating irrigation of 2,140,000 acres—22 per cent of the total irrigable acreage of the State for which water is available, and more than one-half of the present irrigated area. In the same six-months period, applications were received for permits to divert water to generate 2,103,000 theoretical horsepower, largely on streams tributary to the San Joaquin Valley. This constitutes about 26 per cent of the maximum ultimate power development of the state. No wonder that the West is optimistic. It can back up its feeling of confidence with solid statistics.

Merging of the Sierra & San Francisco

The lease of the properties of the Sierra & San Francisco Power Company to the Pacific Gas & Electric Company, for fifteen years, has been approved by the California State Railroad Commission. The total rentals for this period amount to $2,000,000. This merging of interests under the terms of the lease is in accordance with the trend of public utility unification in the West, which appears to be accomplishing much in the way of economy and better service. Certainly in this case, in the words of the Commission's expressed opinion, "the lease is distinctly in the interest of the public," and it is pointed out that for nearly two years the Sierra company has been unable to sell its bonds, and thus handicapped, has not been able to install very necessary power plants and transmission lines. As a result of the lease, service improvements will follow which will be of decided benefit to those territories in which the company has operated —which embrace both central coast and mountain counties of California, including the famous Mother Lode mining district. The Sierra company has also supplied power to the United Railroads of San Francisco, fully 62 per cent of its earnings being from this source.

It is truly gratifying to the electrical industry to learn, immediately upon the merging of the Sierra company, of the appointment of H. F. Jackson, president of the Sierra & San Francisco company, to the position of vice-president of the Pacific Gas & Electric Company, and assistant general manager in charge of electrical construction.

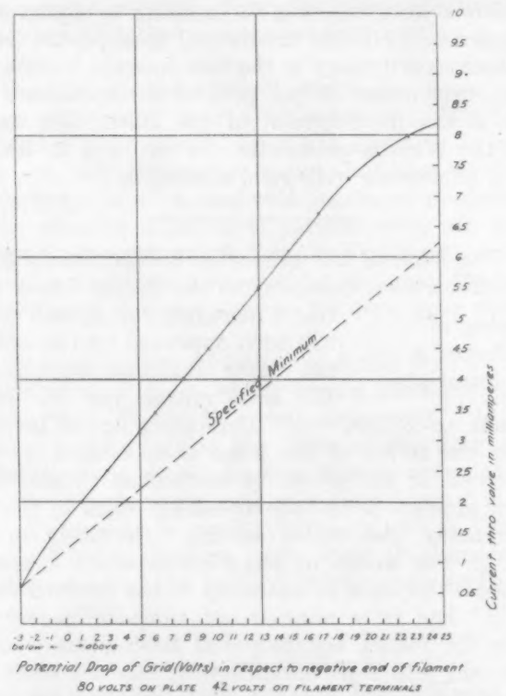
The West needs to retain men of energy and capability, and the Journal of Electricity welcomes the announcement that Captain Jackson's activities will still be devoted to the upbuilding of the electrical West.

Structure and Operation of the Vacuum Valve

BY ROBERT W. A. BREWER

(Successful wireless communication and multiplex telephony depend absolutely upon the reliability and permanence of the vacuum valves used. Private commercial use of these communication methods is at present being delayed owing to the difficulty of obtaining satisfactory vacuum valves; those obtainable are unsatisfactory, due to the variation in their constants. The author, who has recently been in charge of the electrical inspection work of the British army in the West, brings out some of the features upon which depend the uniformity of such valves, that came under his observation as a research engineer.—The Editor.)

The type of valve which forms the subject of these notes is that generally known as the "French" valve. The results of a few typical tests are presented in the form of graphs which have been made by the writer and are taken at random from a large amount of similar data which he has prepared from results of his personal work. This work was undertaken in order to check up the possible uniformity


Specified Minimum
Current thro valve in milliamperes
Potential Drop of Grid (Volts) in respect to negative end of Filament
80 VOLTS ON PLATE 42 VOLTS ON FILAMENT TERMINALS

A P.D. of 30 volts is impressed upon the anode with respect to the negative end of the filament and a local current is passed through the filament at a voltage of 4 across its terminals. The grid is then subjected to varying voltages between —3 and +25, the filament to plate current being plotted as shown in the above curve. Fig. 1.

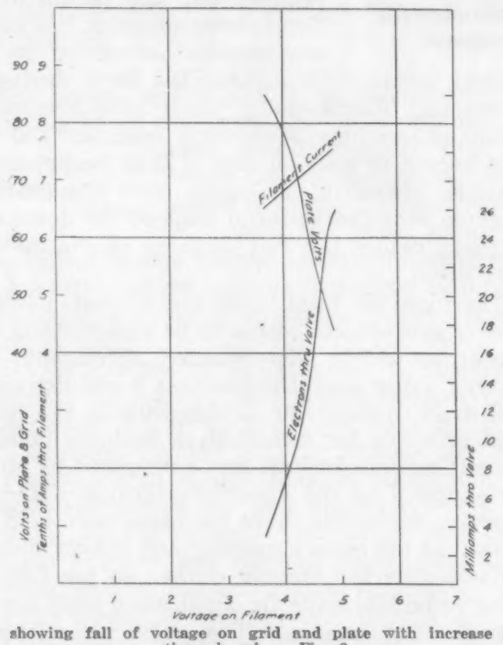
of production of these valves in the method which was devised, also to determine the effect of various errors or departures from the linear dimensions and methods of treatment originally prescribed, so that the limits of such errors could be adhered to.

A few general observations upon the vacuum valve will be useful to the reader who is not fully conversant with the subject.

Primarily, when used as an amplifier of radio signals its function is to render audible such vibrations as otherwise could not be discerned. This type of radio signal may be beyond ordinary audibility, either by reason of its weakness or on account of interference or jamming. There is no particular merit in an amplifier producing a superlative noise, which only militates against the life and usefulness of the apparatus employed. The writer has, however, transmitted speech and received audible signals by means of the valves discussed, in spite of the close proximity of several high powered arc stations transmitting simultaneously, the speech being distinct and clear through the interferences.

Principle of Operation

The principle upon which the vacuum valve operates is that of electronic emission from a hot cathode producing what is known as a thermionic



Curve showing fall of voltage on grid and plate with increase of flow through valve. Fig. 2.

current of negative electricity from the cathode to the anode. Negative electrons are emitted from the cathode in quantity governed by the temperature of the cathode when its dimensions are fixed.

The emission of electrons necessitates the absorption of kinetic energy which has to be supplied by the battery in circuit with the cathode, the group consisting of a filament, say, of tungsten, a six-volt battery and resistance.

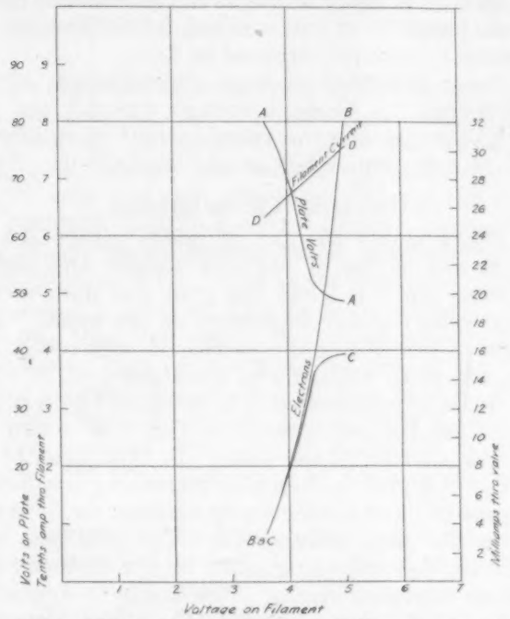
The original Fleming valve comprised an anode as the second element upon which a positive potential was impressed by means of a separate battery, the circuit being completed through the valve to the negative end of the filament. The anode when positively charged attracts the negative electrons emitted from the hot cathode. The electronic flow through the valve bears a relation therefore to the positive potential of the anode, and as this is increased so will the electronic flow increase until saturation occurs.

The capacity of a valve which is purely electronic depends upon the rate of emission of electrons

*The word "Plate" is used to express "Anode" and "Filament" to express "Cathode."

from the cathode which is a function of its temperature and the rate of flow to the anode which is a function of the positive potential of the anode.

Distinct from the purely electronic, or as it is termed the "hard" valve, is the older type of "gas"



Curve showing fall of voltage AA with use of filament current DD and electronic flow CC, grid being disconnected and 80 volts initially impressed on plate. Also electronic flow BB with 80 volts maintained on plate alone. Fig. 3.

valve or "ionizing" valve in which a different action occurs. If gas is present to the extent that 1/100,000 mm. of mercury pressure exists, ionization of this gas takes place, the molecules of gas come in contact with the positively charged anode and themselves assume a positive charge, and are consequently repelled from the anode and bombard the cathode, causing the rapid destruction of the latter. The presence of gases in a vacuum valve cause the formation of positively charged ions plus negative electrons and the latter supplement the electrons emitted from the cathode, thus increasing the electronic flow. A gas valve, therefore, shows on test a greater current flow than a hard valve but its behavior is very erratic.

For this reason a hard valve is preferred in practice, in spite of the difficulty of removing the occluded gases from the metal parts and the glass bulb which form the elements of the valve.

The third or controlling element in a French valve is the grid which is interposed in the electronic path. Its function is to control the current flow through the valve by reason of its variation of potential. The presence of the third element introduces great possibilities, as slight variations of impressed voltages upon it can either check the current flow entirely when acting in opposition, or increase the flow many fold when a positive potential is impressed upon it.

If gas is present in a valve, positive ions are formed between the grid and the cathode, and these reduce the space charge inside the grid and increase the current flow through the valve to such an extent that the action of the grid for its intended purpose is neutralized. A negative charge has therefore to be placed upon the grid to counteract this effect.

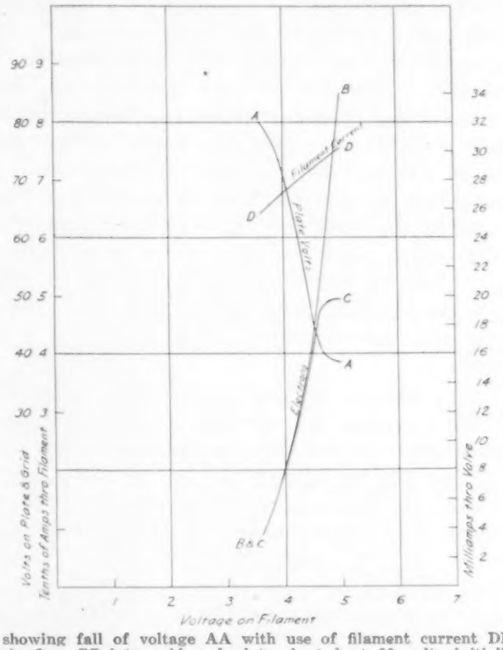
Factors in Construction

In a hard valve the grid assumes a certain positive potential, but it must not be too coarse in construction or it will require a large negative potential to be impressed upon it to make it operative under certain conditions. On the other hand, too fine a construction must be avoided, in order that it shall not form a complete obstruction to the electronic flow. The grid, however, should be placed as near to the cathode as possible. The size of the anode depends upon the desired capacity of the valve as if this element is too small it will become red, or even white hot, due to electronic bombardment.

The dimensional details of the valve under consideration are as follows:

The anode is nickel sheet bent into a cylinder of 10 mm. external diameter by 15.2 mm. long and 0.2 mm. thick. It is supported in position by a small nickel angle piece to which it is spot welded; the angle is welded to a platinum wire for sealing into the glass bulb and to a copper connecting wire.

The grid is a nickel wire 0.25 mm. diameter formed into a series of 11 coils of 4.25 mm. internal diameter. The coils are spot welded to a nickel



Curve showing fall of voltage AA with use of filament current DD and electronic flow CC into grid and plate shorted at 80 volts initially impressed. Also electronic flow BB with 80 volts maintained on grid and plate. Fig. 4.

supporting wire at three places. The filament consists of a crimped tungsten wire 23 mm. long between supports, and of such a length that the current passing under P.D. of 6 volts at its terminals is 0.84 amps.

Tests of Correctness

These three elements are arranged concentrically and the characteristic curve No. 1 shows graphically the behavior of the valve under the following

tests, with the object of certifying the correctness of the disposition of the elements within the valve.

A P.D. of 80 volts is impressed upon the anode with respect to the negative end of the filament and a local current is passed through the filament at a voltage of 4 across its terminals. The grid is now subjected to varying voltages between —3 and +25 and the filament to plate current read off and plotted as in Fig. 1. These values are required to show a straight line between the aforementioned limits and to have an increment of a minimum of 0.2 milliamperes per 1 volt of grid P.D. variation.

The characteristic curve of a valve of the receiving type according to Langmuir's formula should show:

Plate current $= A\ (V_p + K V_g)^{3/2}$.

A being a constant.

K is a constant depending upon linear dimensions of the elements and their arrangement.

V_p and V_g are the potentials of the plate and the grid.

The plotted curve for a French Valve (Fig. 1) passes through observed points at intervals of one or two grid volts which are located along the abscissæ, whilst the ordinates indicate the value of the electronic flow through the valve in milliamperes of filament to plate current.

When no voltage is impressed on the grid the current is 1.7 milliamperes and this is reduced to 0.6 milliamperes when a negative charge of three volts is placed upon the grid. The form of the curve indicates that minus four volts applied to the grid would stop the current flow by building up a space charge of sufficient magnitude for that purpose. Under these conditions the valve will be inoperative until the negative potential of the grid is eliminated. The dotted line starting from the lowest observed reading gives the locus of the curve of the desired minimum current flow having an increment of 0.2 milliamperes per one volt rise of grid P.D. The actual test shows that the valve in operation exceeds this increment, and that the curve is practically a straight line, all the observed points lie exactly on the line as plotted. This test shows that the grid controls the valve action in a perfectly regular manner.

The emission of electrons from a heated filament has a critical point where very slight increase in the temperature of the filament will cause a great increase in the emission. As an example, in the first valves made the filament current was 0.83 amps. at 6 volts, 0.65 amps. at 4 volts, the critical voltage being 4.2.

The most useful test of the correctness of manufacture of a receiving valve is that for the filament-plate current when the grid is externally connected to the plate and a voltage impressed upon them with respect to the negative end of the filament.

Fig. 2 shows results of such a test graphically, but the plate voltage has been permitted to drop as the valve current increased. This drop is due to the decrease of internal resistance of the valve caused by an increase of the bombardment of negative electrons emitted by the hot cathode. The method of making this test is to start the filament voltage at a point where valve current begins to flow appreciably, in this instance 3.6 volts on the filament produce 0.65 amps. through it, and cause a valve current of 3.2 milliamps. when 85 volts are impressed on the grid and plate shorted together.

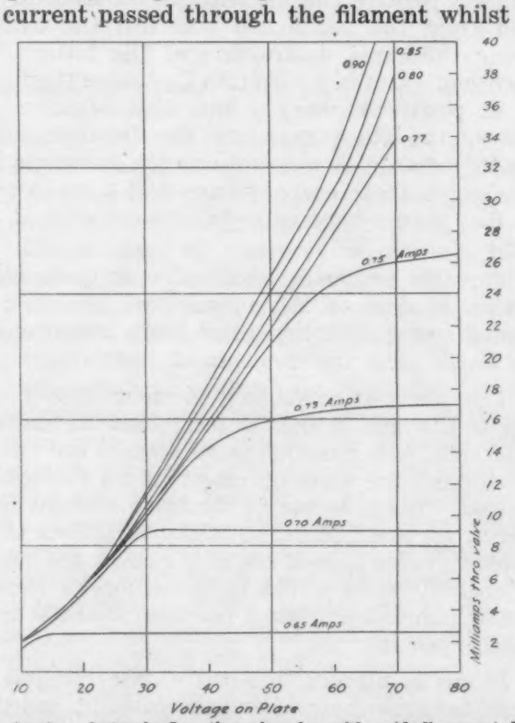
The rheostat in the plate circuit has remained untouched as the filament voltage was increased, so that at 4 volts and 0.68 amps. in the filament circuit the electronic flow has reached 6.8 milliamps. and the plate voltage has dropped to 78.

These observations were discontinued at the point where the filament voltage was 4.9, the current 0.76 amps. and the valve current 26 milliamps. with 44 volts impressed on the anode.

Operating Characteristics

Fig. 3 shows the fall of plate voltage AA accompanying a rise of filament voltage DD and an electronic flow CC when the grid was disconnected and 80 volts initially impressed on the anode. Also the curve BB shows the increased electronic flow when the plate voltage was maintained at 80 volts. This series of curves should be compared with others taken from the same valve in Fig. 4 in which the grid was shorted to the plate. In this instance the effect of the grid is shown as increasing the flow of electrons CC and consequently causing an increased drop in the plate voltage AA. The grid acts as a second anode, and being close to the filament produces an increased strain. This strain is so marked that the writer has observed the lateral distortion of the filament when the plate voltage has been switched on and in some instances the filament has been drawn into the grid and shorted by this action alone.

Fig. 5 is interesting as being typical of the electronic flow through a valve of two elements. Several series of observations from a hard valve are here plotted, the grid being disconnected and a definite current passed through the filament whilst the



Curve showing electronic flow through valve with grid disconnected, and plate voltage increased by steps with filament current constant at various values from 0.65 amps. to 0.90 amps. Fig. 5.

plate voltage was increased step by step. The test was then repeated with an increased current through the filament and so on at varying filament current values between 0.65 amps. and 0.90 amps. The plate voltages adopted in these tests started at 10 volts and were gradually increased by steps to 80 volts, in the four lower sets, and 70 volts in the four higher sets.

The outstanding facts from this series are that a current flow of 0.65 amps through the filament does not cause an appreciable electronic emission, the 2.5 milliamps current indicated is drawn to the plate when 15 volts are impressed thereon, the valve then becomes saturated. Any further increase in plate voltage whilst setting up an additional strain in the valve, does not increase the electronic flow.

When the filament current is increased to 0.70 amps. and the plate voltage is 30, saturation occurs and the slag may be assumed, but this is not very marked. Between a filament current of 0.70 amps. and 0.80 amps. the critical temperature is reached and very marked increases of electronic flow are observed for slight increases of filament temperature.

Within the limits of the apparatus employed it has been possible to find the point of saturation when the filament current was 0.75 amps. as a maximum. This state is shown as occurring somewhat gradually when 65 volts were impressed upon the plate, resulting in 26 milliamps. electronic flow.

The flow through the valve does not increase materially when currents greater than 0.77 amps are passed through the filament. For example, when 60 volts are impressed on the anode the electronic flow is

27.5 milliamps. at 0.77 amps.
29.0 milliamps. at 0.80 amps.
30.5 milliamps. at 0.85 amps
32.5 milliamps. at 0.90 amps.

Curves such as these indicate that the operator should use as low a filament current as convenient in the critical range so as to prolong the life of the filament, and should adopt a plate voltage just below the point where saturation occurs. Plate voltage has generally or frequently to be obtained at appreciable cost and should therefore be considered. This is particularly the case when dry cells are employed.

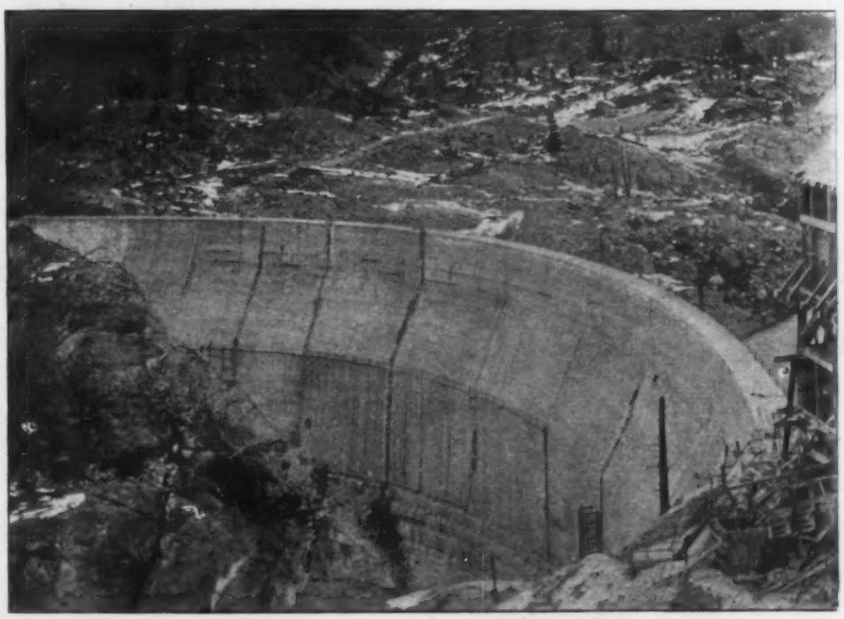
In these brief notes only a few of the interesting features of vacuum valves could be touched upon, and space has precluded any mention being made of the very delicate tests employed to insure correct functioning. Some of these tests involve only fractions of a micro-ampere and yet valves complying with these tests have been constructed in quantities.

The French valves under consideration have been made by hand in England in large numbers and a considerable quantity have been machine made in America.

POWER FACTOR RATE FOR CALIFORNIA OIL FIELDS

A very advantageous load has been built up by the San Joaquin Light & Power Company in the pumping of oil wells in the California oil fields. The load factor of this type of installation is very high, but a rather poor power factor is maintained. The San Joaquin company proposes to better this condition by an installation of synchronous machinery at Taft, California, to cost in the neighborhood of $100,000. This is found simpler to handle than individual correction of the poor power factor.

It is now proposed, and application is at the present time before the California Railroad Commission, to charge the expense of this correction to the installations which are involved, rather than to figure it in as general expense and distribute it through all rates. The proposed method involves the figuring of the kilowatt-hours affected and the calculation of operating and overhead costs per kilowatt. This would result in a very small additional charge per kilowatt to this type of consumer.



The Lake Spaulding dam of the Pacific Gas & Electric Company is 275 ft. high, and spans approximately 700 ft. It is a constant angle arch dam containing 191,500 yards of concrete, the length of the upstream radius varying from 250 ft. near the bottom to 428 ft. at the crest. It impounds a reservoir of 74,000 acre ft. capacity, behind which is a drainage area of 123 sq. miles. The elevation of the crest of the dam is 4875 ft. above sea level. The view shows the recently raised portion of the dam as well as the lack of snowfall in the high Sierra Jan. 1, 1920.

Oil Pipe Line Transmission

BY H. W. CROZIER

(The varying viscosity of fuel oils, and the frequent necessity of heating before transmission, calls for numerous adaptations in pipe line design. The following discussion of the most efficient modern practice in the handling of this important product is by a member of the engineering firm of Sanderson and Porter, San Francisco.—The Editor.)

In making a decision as to the capacity of a pipe line to handle the several different grades of oil which in regular commercial practice would be offered, the most viscous oil is necessarily the controlling factor and the line must be designed to handle it either at full capacity if it predominates, or at a reduced rate if it is only a small part of the oil offered.

Looping and Use of Two Sizes

When existing pipe lines are offered more oil than they can handle, an expedient called "looping" is sometimes resorted to for the purpose of increasing the carrying capacity. This consists in laying and connecting several miles of additional pipe parallel to the operating main line, and eventually additional pipe is laid until a complete second line is built. The additional pipes are called loops by the oil men, but a railroad engineer would call them second tracks.

In Eastern practice, handling constant temperature oil, it makes no difference whether the loop is cut in at the pump end or the terminal end of a pumping division, but in California hot-oil practice it makes a material difference, and the loops ought to be constructed at the terminal end and not at the pump end. The reason will be readily apparent when it is remembered that the loss of heat is proportional to the surface and is a function of the difference in temperature between the oil and the earth; therefore, if the loop is installed at the head or hot end, the heat loss will be greater and the average temperature lower. Furthermore, the added capacity is of greater advantage where the oil is colder and the viscosity greater.

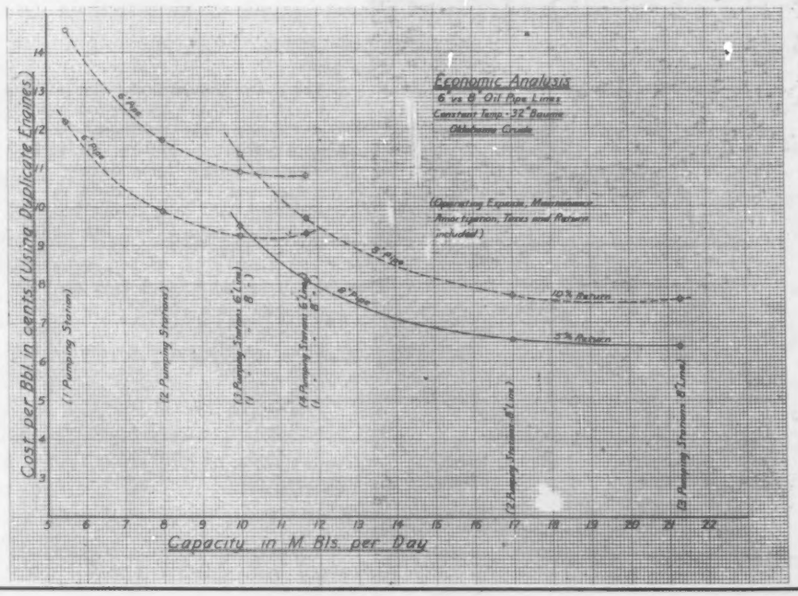
Using two sizes of pipe is another variety of looping and is a very useful method in obtaining a desired result at the lowest expense, particularly in original construction. In handling heavy oils, such as the California oils, very considerable economies in construction are realized by using larger pipe at the end of each division, where the oil is cold and therefore more viscous.

Pumping Station vs. Pipe Size

It is in selecting the best ratio between the number of pumping stations and the proper size of pipe that the engineer can make the greatest economies in the construction of pipe lines. When dealing with oils under constant temperature the problem of selecting the right number of pumping stations and the right size of pipe is comparatively simple, as it involves only the calculation of several different combinations of pumping stations and line pipe sizes properly to handle the quantity of oil decided upon, and the selection of the most favorable arrangement, everything considered.

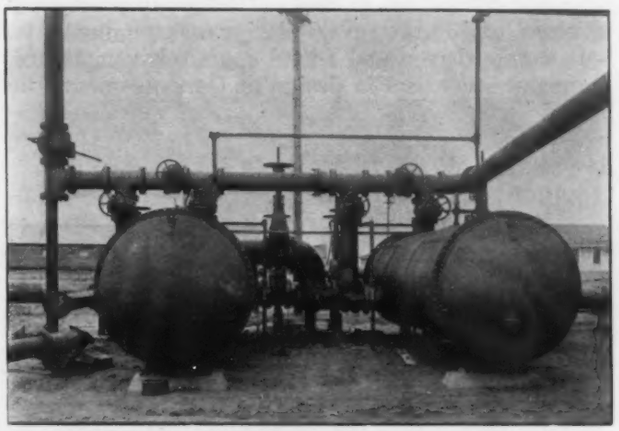
A tabulation which was prepared for the guidance of certain clients contemplating the construction of a line about 130 miles long is illustrated in graphic form in the chart. It will be noted that the maximum capacity of the 6-in. line is 11,700 barrels, requiring four pumping stations, and that by the use of one pumping station and eight-inch pipe at somewhat greater cost, operating expenses would be reduced per barrel of oil. The intersection of the curves gives the critical point below which six-inch pipe is advisable and above which it would pay to use eight-inch pipe. As a general rule this critical point will be found at a velocity above 3½ feet per second.

When dealing, however, with the heavy crudes of California and Mexico, which must be heated, the


Economic Analysis
6" vs 8" Oil Pipe Lines
Constant Temp. -32° Baume
Oklahoma Crude
(Operating Expense, Maintenance, Interest on Investment, Taxes and Return included)
6" Pipe
8" Pipe
10% Return
5% Return
Cost per Bbl. in cents (Using Duplicate Engines)
Capacity in M Bls. per Day

The maximum capacity of the 6-in. line is 11,700 barrels, requiring four pumping stations, and by the use of one pumping station and eight-inch pipe at somewhat greater cost, operating expenses would be reduced per barrel of oil.

problem of proper selection of pumping stations is not so simple, as there is another and very important factor to be considered, difficult of estimation, but which practically controls the situation, and that is the possibility of again starting the lines if



Oil heaters, utilizing exhaust steam. In modern stations the oil heaters are always installed out-of-doors. Practically all the heat of the exhaust steam is used in heating the oil, and there is no waste at the exhaust head.

the oil should cool off during a shut-down due either to accident or design. It is customary in all such lines to provide an auxiliary pump capable of operating at full pressure at very low speeds. In some pumping station designs the auxiliary pump is the same capacity as the main pump normally used, and in other designs smaller, as its purpose is wholly one of relay use and for starting. The practice in Mexico, where very viscous crudes are met with, particularly in connection with sea loading lines, is to install an auxiliary pump for starting, capable of considerably higher pumping pressures than the main pumps. A further consideration from the study of the temperature curves will also indicate that in dealing with heated heavy crudes, it is desirable to operate the pipe lines as near their full capacity as possible, 3 ft. per second at least, so as to conserve the heat as much as possible. Experienced pipe line operators usually move runs of heavy crudes through the lines at fairly high speed, and, if they have any spare capacity, operate slower when pumping the lighter refining oils, because it is desirable to keep the oil always moving.

Materials of Construction

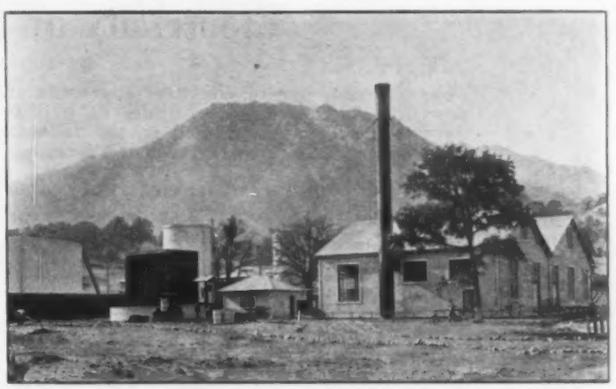
The economic design of pipe lines is very materially influenced by the type of the materials used in its construction. The quality of the steel in the line pipe itself is of the utmost importance, and considerable thought and study has been given to the specifications covering the fabrication of the line pipe. As a general rule, speaking of eight-inch pipe, a line working pressure of about 800 pounds is good practice with the regular standard line pipe. The pressures for six-inch and ten-inch sizes are 930 and 730 respectively, not quite in proportion to the diameters, as the thicknesses are not the same in each size.

In main line pumping station design steel pump cylinders, valve pots and all parts subjected to the line pressure are very desirable, and by the use of this material it is possible to considerably cut the cost of the pumping stations. Several important lines of recent construction have all of the parts subjected to the high pressure oil made of cast steel, or steel pipe, and when compared with pumping stations of earlier design, built when cast iron only was available, it will be realized that very considerable economies have been made. On account of the danger from cracked cylinders and other iron casting failures, two buildings were heretofore used, one for the engines and pumps and the other for the boilers. By gradual evolution this has been modified, and in modern stations the boilers and pumps are all installed in one building. The oil heaters are always installed outdoors.

In a modern design with which the author is familiar, provision was made for the erection of a partition between the boiler room and the engine room if experience should indicate its necessity, but several years operation indicates its superfluity. Such a result is obtained partly through the use of cast steel, which eliminates the risk of unexpected cracks, and partly through very careful design, particularly in regard to the arrangement of the high pressure gaskets.

Steam vs. Oil Engines

In dealing with heated oils, as in California, steam driven equipment is essential because of the



Steam pumping station handling heated oil. In dealing with heated oils, as in California, steam driven equipment is essential because exhaust steam is the most satisfactory medium for heating the oil. In modern stations boilers and pumps are all installed in one building.

necessity for heating the oil, and exhaust steam is the most satisfactory medium. Two types of pumping engines are now used extensively; a so-called low duty type consisting of a four cylinder compound duplex acting pumping engine with four single acting oil plungers, and having a steam economy of about 35 lb. per horsepower hour, and a high duty type, consisting of a crank and fly-wheel cross compound engine usually of the Corliss type driving the four single acting oil plungers through scotch yokes and having a steam economy of about 22 lb. per horsepower hour. Both types operate at 2 lb. back pressure exhausting to the oil heaters. Pumping stations equipped with the high duty type of engine are the cheapest because the saving in boiler capacity and buildings, more than compensates for the extra cost.

As a matter of fact, the thermal efficiency of the California stations works out very satisfactorily, particularly when economical Corliss type cross compound engines are used, as practically all the heat of the exhaust steam is used in heating the oil and there is no waste at the exhaust head. On the other hand, in dealing with the constant temperature pipe line problems of the eastern states where heating is unnecessary, the superior economy of the Diesel engines is a very important factor, and in recent lines constructed the Diesel engine driven oil pumps have been installed, realizing exceedingly high economy in operation. The steady loads of the pipe lines permit the realization of the full advantages of the Diesel engine due to the high load factor. Because of the elimination of the boiler plant and building the cost is about the same as steam equipment.

Oil Pumps

The oil ends of the pumping units used on large oil pipe lines are very similar in design and usually consist of four single acting cylinders placed in pairs back to back, in which chilled cast iron plungers operate at a speed usually not in excess of 240 feet per minute. There has been a gradual evolution in design which has culminated in an arrangement suitable for heavy oil, wherein each pair of valve pots, containing an inlet valve and an outlet valve, is a single steel casting, bolted to the cast steel cylinder and to the cast steel outlet manifold. This design was first proposed and manufactured in California. The inlet manifold subject to only moderate pressures is cast iron. It is standard practice in California to use a double ported steel valve operating on a bronze seat. The practice of the several pipe line companies in this particular is practically identical, and in the several designs of pumping units, both steam driven and Diesel engine driven, the oil pumps are identical in design and arrangement, the only difference being in the number of valve pots provided for the various capacities. The Diesel engine designs are all geared, as it is desirable to permit the Diesel engine to make several hundred revolutions per minute. Our practice is to fit a Francke coupling between the Diesel engine and the set of herringbone gears which drive the oil pump.

Construction

A feature of considerable interest in pipe line construction is the extensive use of machinery. The familiar trench digging machines are nearly always used, except where rock or side hill location is encountered. Pipe screwing machines, painting and enameling machines, and back filling machines have been developed to a high stage of efficiency with corresponding reductions in construction costs. Except in heavily wooded country where the cost of clearing the necessary wide swath for the machine is an important item, all pipe construction work can be done by machinery.

Electricity on Sailing Vessels

BY LOUIS ETSHOKIN

(The increased use of electrical apparatus and electric propulsion on board ship opens up a new field, to the contractor-dealer as well as to the manufacturer and the engineer. Some of its possibilities are indicated in the following article. The author is electrical engineer with the Halcun Radio Company of San Francisco.—The Editor.)

Aboard power-driven vessels, electricity has become very important. The first uses were for lighting exclusively. Now electricity is used for steering, driving pumps, and even for propulsion itself. Thus the latest battleships like the California are entirely electrical.

Some of the finest examples of electrical development are to be found aboard ship. The Sperry gyroscopic compass is one of the most ingenious applications of electrical science which can be found. The Fessenden oscillator is another. Both have been of inestimable value to the Navy, and to merchant ships.

Obstacles to Development

There is one type of vessel, however, which has heretofore availed itself very little of the benefits of electricity. This is the sailing vessel. The reasons for the slowness of sailing vessel owners to install electrical equipment are mostly these: There is no source of power aboard a sailing ship other than a gas engine or donkey boiler used for pumping, etc. Most sailing-ship men are rather afraid of the word electricity and still think there is something mysterious about it. They do not see how they can afford electrical equipment.

These people are in much the same predicament as the isolated farmers used to be, and they use the same arguments in opposing electricity. But farmers all over the country are becoming more and more awake to the advantages of the use of electrical power.

Improved Opportunities

Until a small, reliable gas engine was developed, electricity was not for sailing vessels. Having fire under a boiler for the sake of running a dynamo was more trouble than it was worth. But with the gas engine of today, that will run year in and year out with no attention, the question of power for the generation of electricity is solved. The question of something going wrong in the electrical equipment on board a sailing vessel is also a thing of the past. With standard marine wiring, liberal design, and good construction, nothing can go wrong on the simple equipment which a sailing vessel should have.

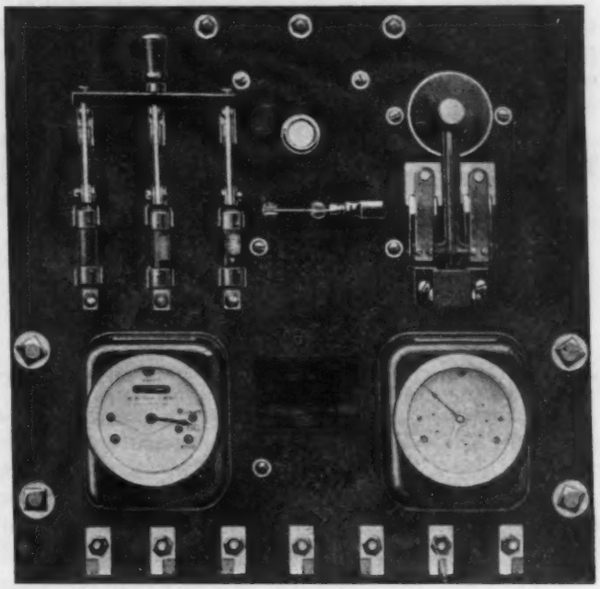
As to expense, there is an initial expense to everything worth having. But electrical equipment will pay for itself in saving of kerosene, lamps, and time spent in trimming lamps. It will pay for itself in immunity from fire caused by overturned lamps, in comfort and convenience for the crew, in ability to load at night, and in many other ways.

A great many sailing vessel captains are accompanied by their wives. How much more comfort is possible with electricity—heaters in cold climates, fans in warm climates, electric iron, electric percolator, and what not.

The Question of Voltage

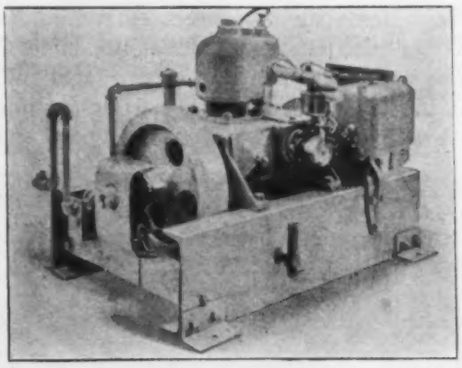
The question now arises as to what type of electrical equipment is best suited for sailing vessel use. Voltage divides equipment of this sort into two great classes, 110-volt and 32-volt. Each has its advantage and disadvantage.

For large sailing vessels, 110-volt equipment is undoubtedly superior. It is easier to get 110-volt



Switchboard for sailing vessel outfit. Marine apparatus should be such that the average mate can run it, and there should be no complicated accessories.

lamps than 32-volt. The same applies to practically all electrical machinery. All, or nearly all, dock systems are 110-volt, and this means ability to use dock electricity for the ship when in port. Wireless equipment, which the majority of big vessels will want after installing electricity, is easier to obtain at 110-



A compact marine equipment for sailing vessels. It is especially necessary that all marine electrical equipment be reliable, as repair facilities are not readily available on the high seas.

volt, although it is obtainable at 32 volts. The majority of small household electrical appliances which the large sailing vessel would want are 110-volt; 32-volt appliances are special.

For very small sailing vessels that want only electric lighting, 32-volt equipment can be used. Its only merit is a somewhat lower first cost, due to fewer storage cells being required.

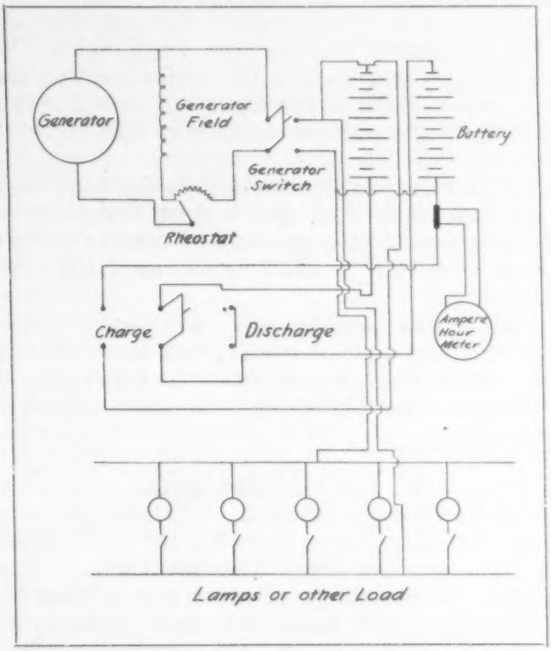
The Six Essentials

The essentials of a good equipment for sailing vessels, in the orders of their importance, are these:

1. Reliability
2. Simplicity
3. Ruggedness
4. Durability
5. Efficiency
6. Flexibility

The first essential of any seagoing apparatus is reliability. You must have apparatus that will not fail you when you need it most. Repair shops are scarce in mid-Pacific.

The next requirement means that the apparatus must be such that the average sailing mate can run it. It must not be too complicated. Ruggedness and durability almost go together. Naturally the apparatus must be marine. Salt water is no friend of electrical or mechanical apparatus, and if the



Essential features for sailing ship wiring. Lamps can be run directly off generator, and can be run while charging. Charging can be varied over wide limits.

ordinary stationary apparatus is used for marine purposes, it will not last.

The apparatus must be efficient, so that too much fuel will not have to be carried on long voyages, and it must be flexible enough so that it can handle more load than the initial installation called for.

A Satisfactory Equipment

These requirements are met by the following equipment.

1. A good gas engine, preferably four-cycle and of marine type, which runs without coaxing.

2. A generator of ample capacity, totally enclosed, and capable of running even under the most adverse conditions.

3. A storage battery which is not going to sulphate or hackle every time it is discharged heavily, and preferably of sufficient ampere-hour capacity to permit of the generator being run not more frequently than every second day.

4. A simple charging panel with one switch for charge and the other for discharge, and a rheostat to vary the charging and discharging voltage. An ampere-hour meter on the board to tell the state of charge and discharge.

5. Simple, substantial wiring throughout, with as little as possible above deck.

Any improvement on these fundamental necessities is desirable if it does not mean a sacrifice of dependability. Too many automatic features are not good for sailing ships unless there is also the alternative of hand operation, if the automatic device goes wrong.

It is well enough to start the engine by pressing a button, but when the engine fails to respond to the pressing of the button it is a different story, particularly in rough weather. Also, why is it necessary for the engine to start up by itself? That is ideal on a farm when the engine may be a quarter-mile from the farm house. But it is not much of a walk to the engine in a sailing ship. Generally the equipment is located near the captain's cabin. Why should he be awakened by the engine starting sometime in the middle of the night? It is better to put the cost of the automatic features into extra ruggedness.

On a great many vessels, it is necessary to run a gasoline pump each day to keep the holds dry. This same gasoline engine can be used to drive the generator, with a resultant lessening of the cost of installation.

All sailing masters who have used electricity are enthusiastic about it. It pays for itself many times over in every kind of way. Its use is becoming more and more common, and will ultimately be universal.

U. S. S. "CALIFORNIA"

The superdreadnaught "California" was launched at Mare Island Navy Yard on San Francisco Bay November 20, 1919. This battleship is almost identical in size and equipment with the "New Mexico," and is by far the largest vessel ever built at the Pacific Coast yard.

She is 624 feet long with a breadth of 96 feet and a draft of 30 feet 5 inches, and 32,000 tons displacement. Her armament will consist of 12 14-inch guns and 38 guns of smaller calibre, with four torpedo tubes.

Like the "New Mexico" she will be electrically propelled. The propelling machinery will, however, be arranged somewhat differently. The two 13,500-kva. Curtis turbine generators will be installed in central compartments instead of the outboard compartments as on the "New Mexico." The turbine compartments will be flanked by eight boilers, four on each side, each in a separate compartment.

There will be four 7000-horsepower motors. The inboard motors will not be in the control room,

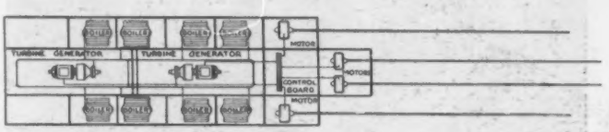
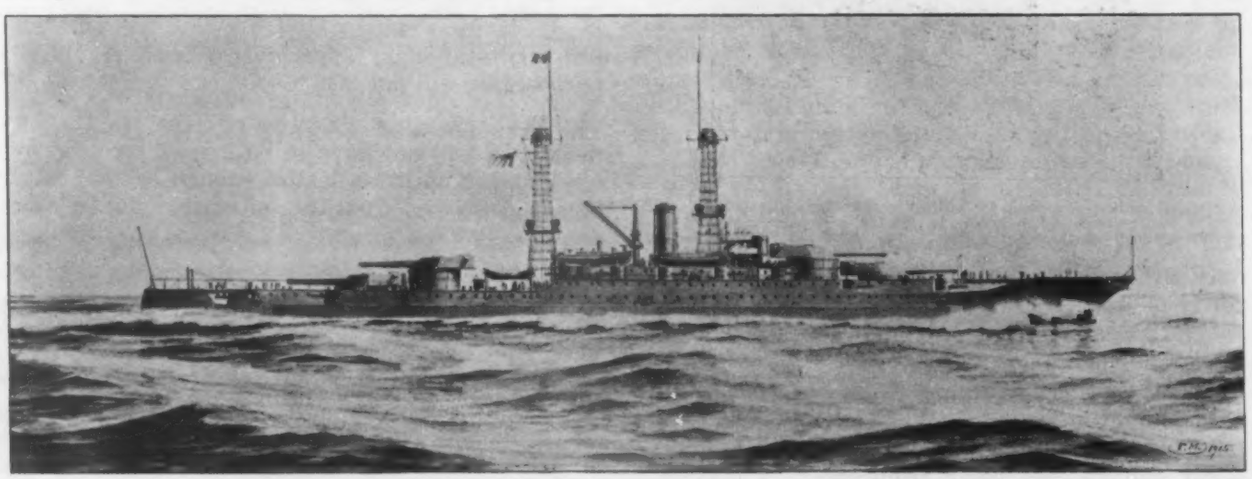


Diagram showing the arrangement of the U. S. S. California's electrical propelling machinery. The turbine compartments are flanked by eight boilers, each in a separate compartment

as on the "New Mexico," but in a separate compartment farther aft. Like the "New Mexico's" motors, pole changing switches will be used for the stator winding so that they may be connected either for 24 poles of 36 poles.

However, instead of the double squirrel cage rotor winding with an outer high resistance, low reactance starting winding and an inner low resistance higher reactance running winding, the "California's" motors will be of the slipring type. The external resistors will be water cooled. Oil circuit breakers will be arranged to short circuit the resistors when desired.

For an auxiliary power to supply excitation and for general use aboard ship there will be in each engine room three 300-kw. direct current units. The "California" will be electrically equipped throughout from the motors operating the turrets to the potato peelers in the kitchen. The electric equipment is being furnished by the General Electric Company.



The U. S. S. California

The Development of Electrical Installation Aboard Ships

BY F. A. ANDERSON

(The impetus given to marine development during and since the war is reflected in the steadily increasing use of electricity on board ship, with the result that special attention is being given to the types of equipment most suitable for marine use. Following is the first of a pair of articles on the subject by the electrical inspector for the U. S. Shipping Board Emergency Fleet Corporation in San Francisco.—The Editor.)

Ships have seen great changes since the day when Columbus crossed an uncharted sea. We have watched the ship grow from the sailing craft to the great steel vessel, with its engines of steam and its screw propellers.

Beginning of Electrical Installation

Almost co-incident with the time when electricity was found useful on land it was adopted for ships, but its progress on ship board has not been so rapid. In the earlier days a one-wire system was used, in which the hull and other metal parts of the ship formed one side of the circuit. That such a system is allowed in some instances for present day service is evidenced by the following quotation from the rules of Lloyd's Register:

"The single wire system must not be adopted for any part of the installation in vessels carrying petroleum."

That electricity has not made greater progress is due in a large degree to a misunderstanding of its possibilities, and these misunderstandings develop into objections among many masters, engineers, ship builders and ship owners. To many ship's engineers everything electrical is surrounded with a cloud of mystery, which is somewhat justified, for through faulty installations trouble often develops which they cannot locate, correct, or control. But when these men understand the advantages of electrical equipment aboard ships and are converted to its use, they lack neither the courage of their convictions nor the ability to promote its adoption.

Correction of Wrong Impressions

We must remove this veil of mystery by giving simple, plain and concise instructions with electrical equipment installed on ships. We must show the valuable service such apparatus can render; then and then only will the pathway for electrical installation on ships be unobstructed.

The present plan for ordinary cargo ships allows only about one to one and a half per cent of the total cost of vessel for the electrical equipment, but such equipment plays a far more important part than that per cent of the ship's efficiency, and is responsible for even a greater per cent in the vessel's safety and comfort.

Specifications and Requirements

It is the general practice in ship's specification to include a clause that vessels be built to the requirements of one or more of the classification societies, and also in accordance with the General Rules and Regulations of the Steamboat Inspection Service. In that portion of the specifications referring to electrical equipment a clause is often added which requires that the installation shall be in accordance with the rules of the National Electrical Code.

Classification societies include electrical rules which are good to a certain extent and which have from time to time been improved to meet the onward march of progress; however, they do not cover many points, and the enforcement of even their present requirements is not always possible, for they possess many alternatives and have been variously interpreted establishing precedents which it is hard to overcome.

I have already quoted from the English authority, Lloyd's Register, and will now quote from the American authority, "The American Bureau of Shipping," who in the preamble of their Rules for Electrical Installation state as follows:

"GENERAL.—All apparatus and appliances such as generators, motors, wire, switches, circuit breakers, cut outs, etc., shall strictly conform in every respect to the standardization rules of the American Institute of Electrical Engineers and the National Electrical Code and such special rules under marine construction requirements contained herein."

This has been the bulwark of strength which has enabled the electrical inspector and the electrical man of the shipbuilding industry to make the improvements and progress which have been accomplished. Much has been done. There is much more to do. Progress has been made, and progress is success.

The rules of the United States Steamboat Inspection Service are short, but they cover a wide field; one of their principal requirements is that:

"Changes or alteration in the electrical installation of vessels now in service shall be in accordance with this rule. Special attention shall be given by the inspectors in the examination of present installation to see that it is of such nature as to preclude any danger of fire, giving particular attention to wiring which is carried through wooden bulkheads, partitions, etc."

Examples of Inferior Work

I want to cite an instance which I think thoroughly justifies such a rule. A few months ago I visited a vessel used for both cargo and passenger service, its electrical equipment had been gone over several times and at the time of my visit included wooden moulding, enameled conduit, B. X. cable and some ordinary lead encased wires. I went aboard this vessel while it was in drydock, and found that the lead encased wire had been drawn into a space between a wooden ceiling and deck for a distance of about fifty feet or over. These wires were secured only to the binding screws of the fittings at both ends of the run, leaving the slack of the heavy wires ample space to swing with the movement of the vessel, and some of the connections had been broken from the fittings by such action. The B. X. had been bent around such short radii that the casing was partly imbedded in the insulation of the wire, causing in some instances complete short circuits where most crude repairs had been made; wires entered and left the enameled conduit without the use of proper fittings; in several instances charred

places were found in and around the wooden moulding. I learned that there were four known fires which had originated from the electrical installation on this vessel, yet this rule of the United States Steamboat Inspection Service was not obeyed at this time, and the vessel again proceeded to sea with only "necessary repairs to the electric installation" having been made, and these consisted chiefly in patching over the defective parts.

There is another instance, which parallels the former in almost every detail, but with some added faults, for here wires were carried through wooden partitions without any protection whatever, many of them being to outside connections subject to weather conditions. This was on a ship built within the past two years, much of its electrical installation was exposed to mechanical injury and willful destruction. Many of the present day rules were disregarded, yet the work was done by an electrical contractor experienced in ship's work.

Conduit Installations

The generally accepted best practice of today for ship's wiring is the conduit system, using so-called steam tight fittings below main deck and in other places subject to moisture, weather, etc., while throughout other portions of the vessel ordinary house wiring appliances are permitted and used.

In many instances the conduit is not required to have the non-corrosive metal coating, although it is a commercial product of today and is required in many places where the danger of corrosion is not nearly so great as in the salt sea air and other conditions prevalent aboard ship.

Lead and Armored Cable in Government Work

The electrical installations under the U. S. War Department at seacoast fortifications were the first of the open work type using ordinary painted boards secured to the concrete structure; on these boards the knobs or cleats secured the wires in position. The life of such installations was short indeed. It gave way to the conduit type which flourished for a time, but the excessive condensation present in these fortifications soon filled the conduit with moisture, destroying the insulation of the wires superinducing electrolytic action, and producing the rapid corrosion of the conduit on the inside, with the resultant breakdown of the system. The next advance was the lead covered cable, the first type being the old flat duplex. This seemed to overcome some of the difficulties, but it was soon found that conditions existed which caused the lead to disintegrate and destroyed the insulation. Then followed the lead and armored cable. This cable was made circular in form by using jute fillers. The lead was covered with a material to protect it from deterioration over which a galvanized iron wire was laid. This type of installation proved the most satisfactory and is the one in present day use. Some of these installations have been in successful and satisfactory service for the past nine or ten years, and without a reported failure, justifying the adoption of the type and proving its economy regardless of first cost. Following this the Navy Department came to a lead and armored type of cable for installation on ships. There are slight differences between the War Department and the Navy Department specifications for insulation and a marked difference in the armor of the cable. Generally the War Department requires galvanized steel wires laid spirally around the lead casings, while the Navy Department use the basket weave type.

Breakdown of an Up-to-Date Installation

There recently returned to its home port a ship which was built and delivered but a few months ago. The electric installation had been made in accordance with the accepted present day practice. It was installed by competent men, the man in charge being considered especially thorough in his line of work. Tests were made to locate possible faults and everything was done to see that the whole installation was free from defects before the ship left on its maiden voyage; yet, upon return to the home port over fifty developed grounds were found in the installation.

Present Type, Ship's Fittings

The so-called steam tight fittings which are generally used are more of a type than an actuality, for it is rare that the abutting surfaces are machined true. Sometimes these surfaces are ground, but quite frequently they are left in their original cast state, depending wholly on an interposed rubber gasket to form the seal. This is not always accomplished, for high and low spots occur which admit the air, saturated air enters, condensation takes place and accumulates in recesses and low spots when deterioration of the insulation begins. Other types of these fittings depend on the glass steam tight globe. Here again is opportunity for failure, these globes are often cracked or broken and, in many instances, are removed entirely from the fitting, which opens the system and defeats the object for which the expense of a steam-tight installation was incurred.

In some installations fittings of the non-water-tight type are installed with improvised gaskets, or other means of converting them into a water-tight type.

It is not unusual to find over sixteen different types of boxes and covers on one installation.

Present Type, Ship's Wiring

The general method of wiring ships contemplates running several circuits in one conduit. This is a practice permitted under present rules of the classification societies, and also the National Electric Code. It is to my mind a mistake for ship's installation.

Present equipment includes running circuits through cargo spaces or holds. The undesirability of such practice is evidenced by the following quotation from the Rules of the American Bureau of Shipping:

> "The method of distribution for cargo spaces must be such that each freight compartment is separately controlled outside the compartment so that the electrical current shall be cut off when the vessel is underway."

The correction of this permitted practice will, I believe, greatly improve installation.

An Electrical Signaling Method for Guiding Ships

BY R. H. MARRIOTT

(Since the advent of the electrically propelled hip, the application of electricity to marine purposes has made great strides, and is doing much to increase safety and efficiency on the sea. The author of the following account of an interesting device is expert radio aid with the 13th district radio materiel officer, U. S. Navy Yard, at Puget Sound, Washington.—The Editor.)

It is evident that vessels have not had means for sufficiently accurate guiding in narrow channels, dangerous channels, and in fog. Largely for this reason many vessels have been lost or delayed. For example: one hundred and sixteen vessels have been lost in Alaska waters north of Ketchikan. Many vessels are held up for considerable periods of time at harbor entrances, for example at New York harbor entrance, where the financial cost for delay may amount to as much as $500 per hour for one vessel. It is believed that re-occurrence of such losses may be prevented by the following method:

A Signal-Carrying Conductor

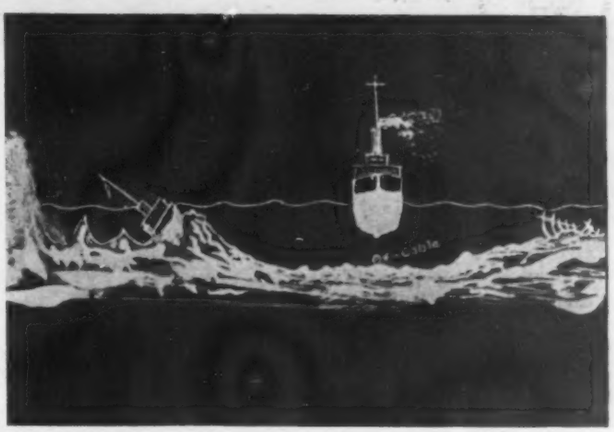
Install a signal-carrying conductor along the sides of the channel or under the channel and pick up the signals on the vessel. For example, when conductors are on each side of the channel, guide the vessel so the signals from the starboard conductor are slightly louder than those from the port conductor. When two conductors are under the channel, one for inbound and one for outbound, keep the inbound vessel in the course that gives loudest sound indicating the inbound guide. The under channel guide would probably be more practical.

The ship receiving device may consist of a coil of wire on an iron core attached to the bottom of the ship with the core athwartship for receiving from a submarine signal wire or vertically to the side of the ship for receiving from a wire parellel to the channel. The winding of the coil may be connected to a pair of telephone receivers worn by the helmsman or navigating officer, or one pair of telephones for each of the officers. Where conditions will permit, the signal may be the spoken word "In" for the inbound channel and "Out" for the outbound channel.

Signal Codes

If desirable and conditions permit, different frequencies of alternating or pulsating current may be impressed in the guide conductors. One frequency for inbound and one for outbound. These signals may be picked up by both telephones and a signal-strength-indicating device, as for example a sensitive ammeter or galvanometer in a circuit resonant to the frequency of the current impressed on the guide conductor. With two or more such indicating devices the relative strength of the fields of the inbound and outbound signals and the relative strength of fore and aft and athwartship fields may be ascertained. Also by controlling the strength of the signal in accordance with the distance from a given point, for example, by grounding a portion of the current through suitable resistances at points fixed distances from the source of supply; the strength of signal would be relative to the distance from that source. Such indications of strength of signal relative to the source of supply (e.g. the dock) and relative to the inbound and outbound signal conductors and relative to the angle the ship makes with the signal conductor, offer the means for a comparatively high degree of accuracy in steering the vessel clear from danger.

A further complexity of circuits may be provided which will afford sufficient accuracy in certain places, for example, the guide may consist of several conductors in one cable, the conductors being of several suitable lengths and suitable speech currents being impressed on them. For example, one conductor could carry a speech current which says periodically "One mile in" while the next in length would say "Two miles in," while the outbound signal wire in that vicinity might say "Nine miles out." The ships receiving circuits may be arranged fore and aft and athwartship in such manner as to indicate whether the ship is approaching the signal conductor or leaving it or is parallel to it or at some angle to it.



By the use of this electrical cable laid along the navigable channel, the ship would be independent of pilots, and could enter a dangerous harbor in the thickest fog, or on very dark nights, without any previous knowledge of the locality.

Special Considerations

Structural conditions of ships, channel conditions, financial and political conditions have their bearings on what structural arrangements would be best to carry out the method. For example, in New York harbor it would probably be entirely practicable to provide all possible refinements and strong accurate signals which could be followed by vessels equipped with the more simple inexpensive apparatus and those which might be equipped with more expensive and more highly accurate apparatus.

In the long passages in Alaska it may be practicable and sufficient for the present to follow the army cable lines. This may be made possible by picking up the telegraph signals and guide signals which might be supplied by the army in intervals between telegraph signals. To do this is more diffi-

The receiving coil is supported on pivots and can be turned around a ver tical axis or tipped around a horizontal axis. The loudest sound is heard when the coil is parallel to the cable and entirely on the same plane. The least or no sound is obtained when the coil is at right angles to that position. In the first of these views, taken looking aft, the ship is proceeding directly along the cable; in the second the cable is on the port side; in the third the ship is crossing the cable, and in the fourth the cable is on the starboard bow.

cult than would be the case if the cable was made for directing purposes, because the army cable currents are weak and the cable is covered with a sheath containing iron. Also the resistance inductance and capacity of the long cables limit the quantity and kind of signals that may be impressed on them.

However, there are several ways which can be used as may be necessary to pick up the weak cable signals although they are in an iron sheath. For example, the pick up current (which can be relatively small) may be lowered from the ship to near the bottom and maintained in the same relative position to the ship; also prescribed frequencies may be used on the cable and tuned receiver circuits and very weak currents may be amplified. The receiving or pick up circuit may include a coil virtually wound around more or less of the hull; one coil, for example, wound in a fore and aft plane, and another in athwartship plane, or a coil or coils inside or above the hull depending on practicability. Increasing the efficiency of the pick up coil, increasing the current in the signal wire, and increasing the amplifiers all serve to increase the possible distance.

Using the Radio Outfit

The signal current in the conductor along the channel may be like that in the antenna of a radio transmitter, and the radio receiving outfit on shipboard may be used to receive it, employing a regular antenna or a coil. Also the coil might be revolvable on its axis so it could be turned to pick up the signal and then turn the boat to the proper fore and aft position relative to the coil, and therefore headed right in the channel.

At this date it is pretty hard to say what is the most practical arrangement to use to suit conditions. It may be best to go along the lines of making the best direction control apparatus irrespective of the radio apparatus and leave the radio apparatus free to handle other things, or it may be best to impress common radio frequencies on the signal conductor or load the antenna for lower frequency so that all vessels equipped with radio could tell when they were closest to the conductor by the strength of the received signal. The Alaska cable is probably not suitable for use with radio frequencies.

Also the use of the common radio frequencies in the guide conductor might interfere with some stations which did not want to receive direction signals but did want to receive messages from some station, and it is easier to build under water conductors for longer wave lengths.

Fifteen thousand meters is about as long a wave length as any kind of a radio station receives at present. Therefore, we might go to a little longer wave length, to which a ship's antenna could be loaded up, and for which a closed coil could be built, and which would be revolvable for getting the direction not only of this conductor but of radio stations. All of which could be received on detectors if interrupted properly.

All things considered, possibly the most practical form for common service would include a standard frequency for all ocean going vessels and for all ports, of say 750 cycles and enough current in the signal circuit to the receiving circuit would not necessarily include anything but a revolvable coil on top of the pilot house, a fixed condenser and a pair of phones with an indicating dial and coil-turning handle in the pilot house.

Such a frequency is applicable to quite long wires, and quite long wires might be required in some places. Also such a sinusoidal frequency and current can be fairly easily obtained from a dynamo and maintained with very small percentage variation. And such a receiving coil and condenser and phones can be fairly easily maintained comparatively constant.

Sinusoidal current and the frequency of 750 or 1500 would serve to cut out some interference. Those frequencies being different from the commercial 60 cycles, radio generator 500 and 1000 cycle frequencies, and seem to be sufficiently different from common motor and dynamo commutator and field frequencies. The average ear is probably most sensitive to about 750 cycles, but quite sensitive to 1500 cycles.

Special vessels (e.g. ferries) which do not use regular channels probably should be provided with

additional special frequencies. On the Alaska cable route special very low frequencies, perhaps twenty cycles or less, would be more practical. It might be found that the longest Alaska cable run has a minimum impedence for a frequency of four cycles or less.

There seems to be sufficient applicable forms, modifications, and combinations to provide a standard arrangement for each group wherein the service and service conditions have a sufficient number of common characteristics.

Results in an Experiment

In a recent experiment a 4000 c.m. rubber covered wire about 700 feet long was dropped over and along the side of a dock into the water. The one end of the wire was bare and in the water, the other end was brought up on the dock and connected to one side of the "break" on a buzzer. The other side of the "break" was connected to the water. Five dry cells were used to operate the buzzer. The wire along the dock under water and the ground return showed a bridge resistance of about 5000 ohms. The predominant frequency produced by the buzzer corresponded to about 1200 cycles. The rubber covered wire in the water was intended to correspond to a short guide conductor in a channel, the center of the channel being along the dock.

The receiving device consisted of a wooden frame four feet square wound with two coils of No. 28 D.S.C. wire. The coils were side by side separated by about 4 inches, each coil having a winding space cross section of about ½-inch diameter. The coils were connected in series and had a resistance of about 1000 ohms and inductance with phones of about 10 henries. There were about 1000 turns. A variable air condenser of .005 max. capacity and a pair of 2200 ohms phones were connected in series with the total coil.

Wearing the phones and carrying the condenser and coil the length of the dock with the coil vertical to the dock and its lower 4 feet side parallel to the signal conductor, it was possible easily to hear the buzzer signals above the noise from riveters near the dock, the wind, induction from commutated circuits, etc.

Measuring the Temperature of Molten Steel

BY F. W. BROOKE

(One of the most recently developed applications of electricity to industrial purposes is in steelmaking, the electric furnace having been brought to a high state of efficiency. The following paper on the handling of molten steel, which was presented before the American Foundrymen's Association, is here reproduced as being of interest to the electrical industry. The author is a member of the Electric Furnace Construction Company, Philadelphia.—The Editor.)

A large number of trials and experiments have been carried out by steelmakers along with the very commendable support of the makers of pyrometers to try and put the measurement of molten steel upon a scientific and fairly reliable basis. Most of the practical investigators have known all along that the measurement of actual temperatures to any degree of accuracy is at present too much to aim for, and have contented themselves with the effort of finding some indication such as a reading on an instrument which tells them when the steel is at the best temperature to produce either a certain type of casting or a first-class ingot with the particular composition of steel they are handling, and that each time this reading is obtained the steel is at its best pouring temperature. In other words comparative tests have been their chief aim.

Use of Pyrometers

Of the scientific instrument methods, we may consider thermo-couples, radiation pyrometers and optical pyrometers. The thermo-couple for temperatures of heat-treatment has proved valuable. In the measurement of molten steel, however, only the rare metal couples can be considered, and even these do not withstand the very severe conditions of a bath of molten steel. Protective tubes, such as quartz tubes, have been tried, but have certain disadvantages. The mechanical strength of a long tube at the high temperature is inadequate; the chemical reaction of the slag in the case of basic operation is undesirable; and the varying thickness of the coating of slag to the tube as it is pushed through the slag causes a varying lag of temperature from the steel to the couple.

The radiation pyrometers, of which the Thwing or the Foster type of fixed focus pyrometer appear to be most satisfactory, require no focusing and the method of handling them is simple. Both of these instruments also have an attachment for taking care of the change in black body conditions from true black body conditions when steel is poured from a furnace or from a ladle. The accuracies of these attachments are not so important, as they are the same for each heat as long as the steel is in a completely molten state. The first obvious objection is that owing to the slag covering in the furnace, and the difficulty and objection of maintaining an uncovered patch, the temperature cannot be read until the steel is being poured into the ladle. While this only allows for correction of temperature in one direction, it still has several valuable advantages. If the temperature of the steel is too low, preference can be given to the heavy castings of large section and the pouring operation carried out as rapidly as possible. If the temperature is on the high side, the steel can be left in the ladle or preference given to all the small castings requiring a relatively higher temperature, but perhaps the greatest value is a check and guidance for the melter and the foundry superintendent on the now existing more or less crude practical methods to be explained later. In the open-hearth furnace, when consecutive heats are being run to the same analysis and same conditions, a certain difference of temperature between steel and slag may be assumed, but this is not very reliable.

The principal objection, however, in the use of radiation pyrometers is the difficulty of always being able to focus through a clear atmosphere and onto a clean stream of steel. In actual practice, it is found that smoky atmospheres and incandescent gases are constantly interfering, while in many furnaces the slag comes out of the teeming spout along with the steel and it is very difficult to know which of the readings recorded represent true conditions, or the same conditions as on the previous heat. There is also a tendency on the part of the observer to record the highest reading on the instrument and interference of a small amount of incandescent gas can escape notice. The following readings are typical of many tests made of a stream of steel leaving the nozzle of the ladle when pouring castings of easy section of about 30 to 100 pounds in weight and 0.25 to 0.35 per cent carbon, by the same instrument and the same observer, the resulting castings being of first-class quality.

Heat No. 7			Heat No. 23		
Mold	Degrees Cent.	Degrees Fahr.	Mold	Degrees Cent.	Degrees Fahr.
1	1510	2750	1	1530	2790
2	1560	2840	2	1540	2800
3	1515	2760	3	1210	2210
4	1740	3170	4	1560	2840
5	1530	2790	5	1490	2710
6	1580	2870			

It is obvious that the readings on the fourth mold of heat No. 7 and the third of heat No. 23 were decidedly off, although every care was taken on both these heats to get uniform conditions, and the error is undoubtedly due to incandescent gases and smoky atmosphere. Results both better and worse were obtained, and these are given as typical when every care was taken.

Practically the same limitations are noticed with optical pyrometers as with the fixed focus radiation type, the added disadvantage being that with every type of optical instrument there is more of the personal element brought in by the matching of intensities or the matching of colors. On the other hand, they are not so liable to damage by the too close proximity to the molten metal, as an observer has less fear of sticking a long tube up to the stream than of bringing his face too near.

Of the practical methods known, the film, rod and pouring tests are in constant use at various electric furnace plants, and they are all depending upon uniform conditions existing when each test is made. The use of the film test originated from the crucible steel practice, it being the best practice in making tool steels to first close all the melting shop doors; then to pull the pots after the required stewing and remove the lid and slag; make any additions and then carefully watch the bright surface of the steel for the first sign of an oxide film forming, this being the sign to commence pouring operations. In the absence of drafts, this served as a fairly reliable temperature indicator, as the crucibles and the mass of steel were usually the same, while the varying composition of the steel could be allowed for by pouring as soon as the first speck appeared, or so many seconds later. In electric furnace practice, this consists of using a steel spoon of uniform capacity, dried out thoroughly over the bath, and giving this a total covering of slag in the furnace. A sample of steel should then be taken, which fairly represents the whole bath, remembering that when a door has been left open for some time the steel near the door has become chilled, and with steel made in an electric furnace where all the heat is applied at the top only, the temperature of the steel directly under the slag is higher than the temperature of the steel near the bottom. Where this is the case, the bath must be thoroughly rabbled before any sample is withdrawn, and even then the sample should be taken at a place equidistant between the electrodes and half way down the bath, so as to arrive at an average temperature. The measurement of the temperature is then indicated by the length of time it takes for an oxide film to completely cover the sample after the sample is taken from the bath. This method is also influenced by the composition and physical condition of the bath, as for molten steels of the same temperature this time varies, principally with the carbon contents, the silicon contents, other alloy contents and the state of deoxidization. Therefore, final comparisons must only be made between steels of approximately the same composition and when the furnace is ready to pour. Care must be taken to keep the sample away from drafts and to have about the same amount of steel in the spoon each time. To show the range of this test it has been noted that first-class high-speed steel ingots of a composition approximating carbon, 0.65; tungsten, 17.5; chromium, 3.75, and vanadium, 1 per cent, were produced when the film (with a later characteristic wrinkling of the surface) was formed directly the sample spoon came through the door, while good castings of about 0.25 carbon and weighing from 30 to 200 pounds were produced when the film took 60 seconds to form after passing the furnace door.

Factors Affecting Use of Rod Test

The rod test has been used for many years as a rough indication of the temperature of many molten metals. The first publication noted by the author of this test being made a standard practice under uniform conditions was from a large Italian steel works. This test requires the use of rods of steel of both uniform diameter and fairly uniform composition, and consist of plunging the rod into the bath of steel and gently moving it through the bath for a uniform length of time. If the steel is cold there is a deposit of the bath on the rod; if the steel is hot the bath melts away or bites into some of the rod, with all intermediate conditions indicating varying temperatures. The skin of the bar, it will be noted, has an effect on this test; a newly rolled bar with a bright scaly surface tends to show a colder bath than is actually the case. The bar before being plunged into the bath should be of uniform temperature and in some steel works this is taken care of by bending about 12 inches or more of the end of the bar at right angles; holding the bar with the bend in a horizontal plane over the bath until it shows the first sign of sagging and then turning the end

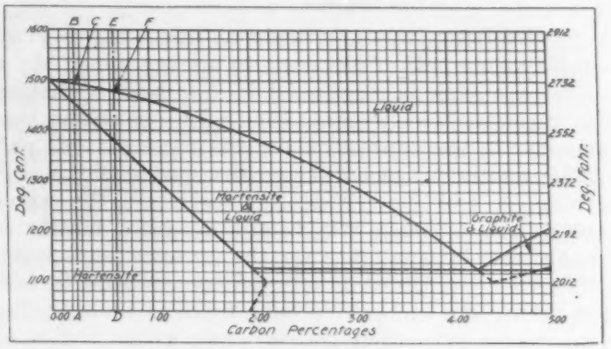
of the bar into the bath. This test again depends on the physical condition and the composition of the bath. This test is also very useful for testing the difference in temperature between the top of the bath and the bottom of the bath and is one of the best indications of the value in electric furnaces of the bottom heating type. Several tests were carried out on a furnace of the Graves-Etchells type and not a single test showed any indication of marked difference in temperature between the top and the bottom of the bath and in every case it was shown that in a furnace of this type there is no need for any mechanical stirring of the bath. Considering the crudeness of this test and the fact that the rod had to be passed through a slag, the uniform effect of the bath on the bars was quite remarkable, both for baths that were relatively cold and hot.

Temperature is Indicated by Fluidity of Metal

The pouring test consists of using a spherical spoon of above 5 inches in diameter and carefully slagging up this spoon over the bath. Dip the spoon quickly into the metal so as to get a sample of the steel from about the center of the bath. Withdraw the sample and carefully pour out the steel over the lip of the spoon at a slow even rate. The temperature of the steel is noted by its fluidity, and by the amount of steel skull that is left on the spoon. This test is the one most commonly used in steel foundries. It is simple and the very nature of the test gives confidence to the man who is responsible for pouring the heat. If he sees every drop of the steel pouring nicely over the lip, he feels that in pouring from the ladle itself the castings of small section will fill up and there will be no skulls left in the ladle. This test is subject to the spoon being properly slagged up, the rate of pouring the sample, and absence of drafts.

For all these practical methods too much emphasis cannot be placed upon the fact that they are all comparative tests only, and that they depend entirely upon uniform conditions, and attention to details. In all cases at least two of these methods should be employed. They do not of course indicate to the melter the temperature of the steel in degrees, Cent. or Fahr., but they do give him a very good indication of the degrees of temperature that the steel is either above or below the temperatures which will give him the best results for the composition of the steel he is handling, for the weight and for the type of casting he is making. In making steel castings it is important that the foundry foreman or superintendent be present when the final temperature tests are being made. He is in a much better position to know how hot the steel must be to suit the castings on the floor. To tell the melter that castings are averaging 30 pounds and then to leave decisions regarding temperature to him, is insufficient.

The question most frequently asked while trying out the above tests was: "How accurately can you measure the temperature of the steel and what temperature should the steel be when it leaves the furnace to give the best results?" The first part of the question refers to the use of pyrometers. On steel works where the best conditions for the pyrometer can be obtained, there is still the limitations of the pyrometers themselves. As already explained, only the optical and the radiation type offer a good field for these high temperatures and conditions, and there is little doubt that an error of plus and minus 50 degrees Fahr. in the instrument itself is all that we can ever expect. To an investigator first



STANDARD CARBON-IRON CURVE

starting in with a new instrument he has just bought, this may not sound very encouraging as he naturally feels that if the steel proves to be 50 to 100 degrees Fahr. less than what he is aiming for he will spoil some of his castings.

Determining Best Temperatures

Probably the best reply to the second part of the question is that the temperature in question is that at which the particular steel begins to solidify, plus the loss of temperature from when the reading is taken to when the steel gets to the farthest end of the thinnest section in the casting. A further query to this second part of the question invariably was: "But how are we to know what these two values are?" The first value depends on the composition of the steel, the carbon contents being the principal factor. This can be obtained by reference to a standard carbon-iron curve, such as shown in the accompanying illustration. For a steel containing 0.25 per cent carbon, trace the line A B till it intersects at C giving a value on this curve of 1492 degrees Cent. (2720 degrees Fahr.); for a steel containing 0.65 per cent carbon, trace the line DE till it intersects at F, giving a value 1476 degrees Cent. (2690 degrees Fahr.), and so on. For other elements in the steel commonly used in castings the variation is not of importance and does not compare with the many other sources of error that crop up in reading the temperatures of molten steel in a foundry. The second value depends upon such variables as the heat of the ladle, the thickness of ladle lining, time of reading to pouring, whether molds are of dry or green sand, and thickness and lengths of the thinnest sections. All of these factors depend very much upon local conditions, and it is regarding this problem that constant consultation between the man responsible for the steel in furnace and the man responsible for making up the molds is so valuable. Final results are only obtained by the constant comparison of the quality of the final castings with the results obtained by their methods of reading the temperatures of the steel.

Revising the Gravitational Constant

BY DR. A. C. CREHORE

(In this discussion the author, one of our best known authorities as a physicist, shows how this new theory may upset the hitherto given values of the gravitational constant involved in applying Newton's great law of gravitation. Further comment on this interesting discussion may be found on the editorial page of this issue. This article is the sixth in a series appearing in the Journal of Electricity by this noted author, on the subject of The New Physics. —The Editor.)

Applying the gravitational force above given for a single pair of electrons to a large multitude of electrons such as must exist in any mass of matter, it becomes evident that the only quantities that change in the expression for the force, as one pair after another is included, are the speeds of the electrons, β_1 and β_2. Evidently, therefore, the whole attraction between two bodies of gross matter is expressed by summing up the β^2 over each body, the other quantities coming out as common factors in taking the sums. We have then, as representing the whole attraction between two gross bodies of matter, the equation,

$$F = \frac{1}{3} m_o e^2 \Sigma_1 \beta^2 \Sigma_2 \beta^2 r^{-2},$$

where r now represents the distance between their centers of gravity.

Speeds of Electrons

It is not possible to proceed further to get a numerical value of the force expressed by this equation until something is known about the values of the speeds of the electrons in the atoms. In order to arrive at a numerical value of these speeds let us now anticipate some of the results that come from the theory of the atom described in a later section.

If an electron revolves in a circular orbit with a frequency, n, it describes n circumferences in one second of time, that is, it travels a distance $2\pi an$ in one second, which, therefore, represents its absolute velocity, v. The theory of the atom, to which we are coming later, says that the frequency of revolution of the two electrons in the hydrogen atom is equal to twice the Rydberg constant, 2K. Hence their velocity must be

$$v = 4\pi a K, \text{ cm. per sec.}$$

And, again, the theory makes the kinetic energy of the two electrons together in the hydrogen atom equal to the product of Planck's constant and Rydberg's constant, h K. Hence,

$$m_o v^2 = h K.$$

But we have already obtained a value for Rydberg's constant, namely

$$2K = m_H \left(\frac{c}{e}\right)^2,$$

and from these, by eliminating the K, we obtain

$$v^2 = \frac{h}{2}\frac{m_H}{m_o}\left(\frac{c}{e}\right)^2 = \beta^2 c^2.$$

Hence

$$\beta^2 = \frac{h m_H}{2e^2 m_o},$$

and

$$\beta = \frac{\sqrt{2}}{2e}\left(\frac{h m_H}{m_o}\right)^{1/2}.$$

The above gives the speed of an electron in the hydrogen atom in terms of known constants. There are two electrons in a ring in this atom, and there is good reason to believe that the formula for the speed of any ring of p electrons may be obtained by putting p in the place of the 2 in the numerator above, thus giving the general expression for the speed of the electrons in any ring as

$$\beta = \frac{\sqrt{p}}{2e}\left(\frac{h m_H}{m_o}\right)^{1/2}.$$

Squaring this expression, and then multiplying the result by the number of electrons in the ring, the sum of the squares of the speeds of all the electrons in the ring is obtained. In the case of the hydrogen atom, where $p = 2$, this sum is

$$\Sigma_H \beta^2 = \frac{h m_H}{e^2 m_o}.$$

When dealing with a single atom of hydrogen alone, having but this one single ring of electrons, this last expression represents completely the value of $\Sigma\beta^2$ required in the gravitational formula above given. Let us, therefore, write down according to these ideas the gravitational force on the average between just two hydrogen atoms at a great distance from each other. Since the two atoms are alike, the product of $\Sigma_1\beta^2$ and $\Sigma_2\beta^2$ is merely the square of the above value, and we evidently obtain as an expression for the whole force

$$F = \frac{1}{3}\frac{h^2 m_H^2}{e^2 m_o} r^{-2}.$$

The values of these constants are known, and hence the magnitude of the force may be calculated. But, if it is the same as the average gravitational attraction according to Newton's law, it must agree in magnitude with the following:

$$F = k' m_H^2 r^{-2}.$$

This is the force expressed by Newton's law on the average between two hydrogen atoms, where k′ denotes the well known gravitational constant. Equating these two expressions for the same force, the m^2_H and the r^{-2} cancel, and the gravitational constant, k′, becomes

$$k' = \frac{h^2}{3e^2 m_o}.$$

The dimensions of this expression are correct, for by Newton's law $k' = F r^2/m_H^2 = L^3 M^{-1} T^{-2}$ on the common system, or $L^2 T^{-1}$ on the space-time system. By using the dimensions on the space-time

system given in Table I for the quantities on the right of the equation, it will be found that they are the same as the dimensions of k′ just obtained.

Numerical Value of the Gravitational Constant

The numerical agreement between the experimental value of k′ and the numerical value obtained by substituting the best values we possess for h, e and m_o is not as close as the agreement heretofore obtained between the theoretical values and the experimental values above in the cases of e, h, m_H and m_o. The value of k′ obtained experimentally is about 666×10^{-10}, and the value of the right hand member above is 703.69×10^{-10} when we take $h = 6.558 \times 10^{-27}$, $e = 4.763 \times 10^{-10}$, and $m_o = .898 \times 10^{-27}$.

There are many difficulties presented in obtaining an accurate experimental value of the gravitational constant on the centimeter, gram, second system. Astronomers usually take the mass of the earth as unity in all astronomical problems, and the work of the astronomers alone is not sufficient to give a numerical value for k′. These measurements really come within the province of the physicist. The evidence for a greater value of k′ is so strong in the author's opinion that it is his belief that some day it will be possible to find where the present methods used for obtaining its numerical value require revision. The present value needs to be increased by about 5% to bring it into exact agreement with the theory. There is more confidence in the experimental numerical values of the other constants involved than there is in this one.

Great New Irrigation and Power Developments

BY CHARLES H. LEE

(Phenomenal increase in the applications for unappropriated waters in California is shown by the statistics herein presented by the executive member of the State Water Commission of California. They show that in the past six months applications have been filed contemplating active development of 26% of the maximum ultimate hydroelectric power resources of the State. —The Editor.)

The State Water Commission of California has recently compiled data which shows in a striking manner the resumption of activity in agricultural and hydroelectric power development during the past year. Not only does this data indicate a return of normal activities, but it shows in addition an increase of nearly 40 per cent over the average for the past five years. California is launching upon a period of unprecedented development.

The State Water Commission has supervision over the use of unappropriated waters of California. These waters were declared to be public property under the Water Commission Act which went into effect on December 19, 1914. Under this act, applications must be filed with the commission for permit to use unappropriated water. The principal applications received are for irrigation and generation of hydroelectric power, but the demand for mining and municipal uses is also considerable. During six months ending December 31, 1919, 62 per cent of the applications received were for agricultural, 30 per cent for power, 6 per cent for mining, and 2 per cent for municipal uses.

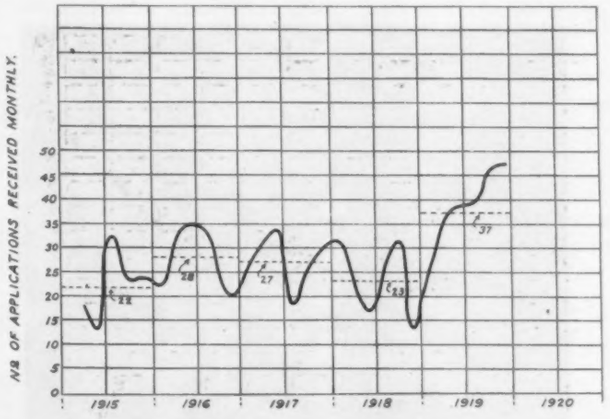


Chart showing the remarkable increase during 1919 of applications for water-appropriation in the state of California.

The relative number of applications received by the commission is a reliable index of the general business and financial condition throughout the State. The data for the period since the commission was organized in 1915, has been made available in the form of a diagram showing the number of applications for permits which have been received monthly. The outstanding facts shown by this diagram are the influence of the war, and the resulting high prices, upon agricultural, power and mining development in the State. Prior to the active participation of the United States, there was a normal increase from year to year, with a periodic summer peak. In 1917 the peak did not reach its anticipated climax, but fell off rapidly immediately after the declaration of war in April. The efforts to stimulate food production resulted in a partial recovery late in 1917 which reached its climax early in 1918. The average for the year 1918, however, was 18 per cent less than in 1916, and 15 per cent less than in 1917. The month of the armistice, November 1918, produced a sharp decline with a minimum below that of any previous month in the history of the commission. The subsequent recovery has been rapid, the rise continuing steadily to December, 1919. The number of applications received during December, 1919, was 33 per cent greater than in any previous month, and for the year was 37 per cent greater than the average for the past five years. This unprecedented activity is the result of the prevailing high prices for agricultural products and the more intensive cultivation of the soil by means of irrigation.

Agricultural Development —

The applications are for widely varying amounts of water and for the irrigation of from a few acres by homesteaders in the hills to several hundred thousand acres by irrigation districts in the San Joaquin Valley. The extent of the immediately proposed agricultural development in the State is indicated by the fact that the total area of land for the irriga-

tion of which applications have been filed during the six months ending December 31, 1919, is 2,140,000 acres. This area is 22 per cent of the total irrigable acreage of the State for which water is available, and is more than one-half of the present irrigated area. The lands applied for are principally in the great valley of Central California, and include the Merced, Madera, San Jose, proposed Kern Delta, and other large irrigation districts in the San Joaquin Valley, as well as rice lands in the Sacramento Valley.

Hydroelectric Projects —

Hydroelectric power development is fully as active as agricultural development. For the same six months period applications were received for permits to divert water to generate 2,103,000 theoretical horsepower, largely on streams tributary to the San Joaquin Valley. This quantity is 26 per cent of the maximum ultimate power development of the State as stated in the report of the U. S. Commissioner of Corporations in 1912. The largest proposed installations are those of the Southern California Edison Company on the San Joaquin River, totaling more than 1,000,000 theoretical horsepower at nine power plants, two of which are already in operation. Others are the San Joaquin Light & Power Corporation plant on San Joaquin River, with 33,000 horsepower; the Modesto and Turlock Irrigation District plant on Tuolumne River, with 45,000 horsepower; and the Mokelumne River Power & Water Company on South Fork Mokelumne River, with 32,250 horsepower.

Necessity for Storage —

This phenomenal increase in the use of the waters of the State brings forcefully to attention the absolute necessity of the storage of surplus waters for use during the periods of shortage. This is necessary not only for irrigation but for power development, and most of the applications filed with the commission include storage of greater or lesser amounts. The acuteness of the situation is indicated by the fact that even in the Sacramento Valley, during the late summer, a shortage is imminent in the flow of the Sacramento River. The normal flow of the river is being appreciably reduced each year by the increasing amounts used for the irrigation of rice. If this industry continues to expand as it has during the past four years, storage must be provided. There is strong probability during the coming season, not only that the river will be largely diverted but that a considerable acreage will be without water during the latter part of the growing-season, unless a limit is placed upon the acreage planted.

The difficulties of financing large storage projects, and the diverse interests depending upon the use of storage water, both point to the desirability of the construction and operation of large reservoirs by the public. The Federal Government is not prepared to undertake storage projects on a broad scale in California principally because of lack of funds. The logical procedure is for the State to undertake such enterprises.

ANNOUNCEMENT

MORE LIGHT —— BETTER WIRING

—in the home
—in the school
—in the street
—in the show window

GOOD LIGHTING PAYS

The next issue of the Journal of Electricity will include a comprehensive paper by F. D. Fagan of the Edison Lamp Works, dealing with the value of proper illumination in all departments of human activity.

To foster the use of

ELECTRICAL APPLIANCES IN EVERY HOME

cooperation between builder, architect, contractor and publicity man must bring about the proper wiring of houses. Six great factors in promoting adequate employment of baseboard receptacles will be introduced in an authoritative paper by Garnett Young of the Garnett Young Company in the next issue of the Journal of Electricity.

These two papers are the first advance material from the

1920 N. E. L. A. CONVENTION

Western Ideas

FEATURE ILLUMINATION which is effective in result and which requires no extensive and expensive installation is often a desirable adjunct for a celebration of which electrical illumination is a feature. The Griffith-McKenzie Building of Fresno, California, developed an interesting such arrangement during war times, which is susceptible of modification to meet particular conditions. As can be seen from the photograph, this is obtained merely by the illumination of certain specified windows to form a design against a dark background of the re-

A design in lighted windows

mainder of the building. In this case it is the large block letters "U. S." It is obvious, however, that any purely conventional design can be carried out with a little ingenuity. With a very trifling expense, colored effects may be obtained by the temporary substitution of colored lamps or colored shields for the desired windows. The opportunity for lamp sales and the encouragement of a growing use of electric illumination is a field which should not be overlooked by the contractor-dealer.

AN INTERESTING WINDOW DISPLAY used by the Electric Appliance Company of Seattle is a single Thor Washer containing suds that will pile up eighteen inches or more, made with borax soap and

Colored lights are played on the moving soap suds, and the effect is one which attracts constant attention

a little hot water. The effect of this billowy mass of moving suds attracts a great deal of attention.

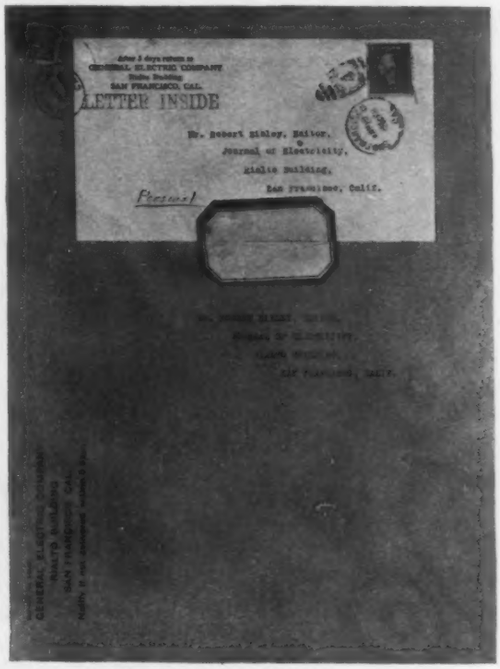
To make the display still more striking, a many-colored revolving screen is mounted on the ceiling of the window, and a high-powered auto searchlight placed behind it. This throws a changing colored light on to the soap and gives the effect of lights inside the washer.

One framed advertising card, 12 x 22 in., hangs in the window, bearing the following inscription:

—This is Mrs. Thor
She works for ½ cent an hour
Eats no lunch
Washes Clean

COMBINATION ENVELOPES can be a great boon both to sender and recipient. It is usually desirable that the reader of a letter should have before him the bulletin or catalogue to which reference is made in the letter. If the bulletin comes along later in another mail, much of its effectiveness is lost.

The General Electric Company in San Francisco has been accomplishing this purpose by the use of a combination envelope which is merely an ordinary business size envelope pasted onto a larger bulletin size envelope. Both envelopes must be addressed and the proper postage separately affixed. This will insure separate delivery in proper shape should the two envelopes become detached in the mails.

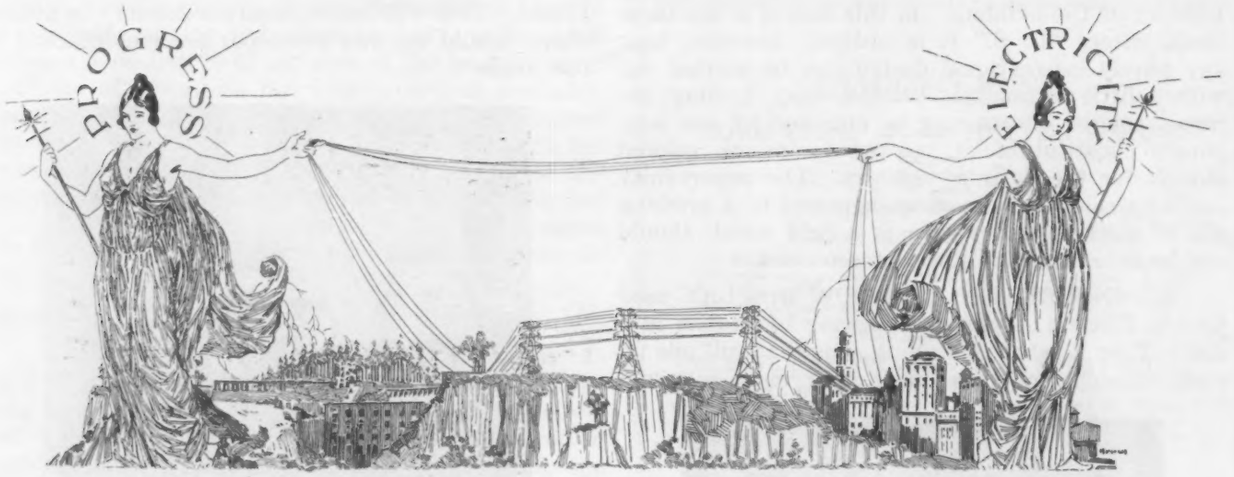


A simple combination-envelope device which can be employed by anyone without the purchase of specially manufactured stock

This plan meets with the approval of the postal authorities. First class postage is required on the letter envelope and third or fourth class postage (according to weight) on the bulletin envelope.

Knocking machine used by the Electric Appliance Shop of Los Angeles

KNOCKING is a more or less dangerous and unpopular pastimes these days, but there are still a few who may do it with impunity, among them "Maude," shown in the accompanying picture contributed by the Electric Appliance Shop of Los Angeles. This ingenious knocking machine is not merely a proof of the durability of the lamps which Maude maltreats from dawn to dewy eve, but is a display which arrests the attention of every passing child, grown-up or otherwise, and makes the store a landmark on its street.



The Spirit of Progress

BY S. M. KENNEDY

(To every branch of practical human progress—transportation, communication, home-building—electricity has brought an incalculable contribution. The general agent of the Southern California Edison Company here reviews some of man's most notable achievements in the advance of civilization, and the part played by electricity in their development. This is the seventh article of the series.—The Editor.)

In these latter days, the word "progressive" is dinned into our ears to such an extent that some people are liable to misunderstand its meaning or become absolutely tired of it. However, we of the electrical fraternity know that as progress leads to perfection, the progressive spirit is something to be cultivated by all connected with the great industry of which we are a part. If we are to progress we must be active. We must neither mark time nor stand still, for if we are not moving forward, we are slipping behind. Perhaps the American people comprise the most progressive nation in the world, and the most restless and inventive American is the Yankee. No less an authority than Chauncey M. Depew has stated his belief that the great inventiveness of this same Yankee is due to his fondness for pie. Pie twice or thrice a day will eventually produce indigestion in the strongest stomach, and with indigestion a man cannot sit still and remain peacefully contented. He must have action, mental and physical, and action will invariably produce results.

Land Transportation

Let us glance at the results of the progressive spirit in businesses which might be considered as co-related to the one in which we are engaged—that is the electric industry. This refers particularly to transportation, the telegraph and the telephone. Transportation has, properly speaking, three divisions: land, water and air. Land transportation may be traced back to the period when mothers first strapped their babies on their backs. Since that time more patents have been issued upon inventions relating to transportation than upon any other line of human activity. They range all the way from a tiny device for unhitching a runaway horse to the latest idea in guiding an automobile. It is well to pause and consider what this wonderful development in land transportation has meant for the civilized world; how the spirit of progress has linked country with country and nation with nation, so that together and with the aid of each other they might move forward to fulfill their destinies. Think how these many railways have prevented the close congestion of population in large cities by opening up the surrounding territories, and reducing the time from the suburbs to the center. Railroads have made the rough places smooth; have annihilated distances, and at times have almost rivaled the sun in their speed. Progress is now beginning to revolutionize railway travel. Instead of continuing with the wasteful use of coal or other fuel, many railroads are figuring on changing their motive power from steam to electric—in fact, there are some thousands of miles of railroads in America already converted. In addition to the more economical operation with electricity, there is an additional advantage—for electric power increases the capacity of a single track road anywhere from fifty to eighty per cent.

Electricity on the Sea

Some of our fathers and grandfathers came from Europe in vessels which were conspicuously uncomfortable for passenger travel, as we now look back on them, but they were considered wonderful ships in those not so very far distant days. Should you now desire to go to Europe, you will observe what a marvelous change has been brought about by this same spirit of progress. You are ushered on board a great floating hotel, a structure so big that only giant waves have any material effect upon it, and so powerful that the energy it contains is measured by tens of thousands of horsepower. When you wish to move about on this castle there are servants at your beck and call for all purposes, and electricity is the servant of the servants. Little electric

railways operate in the bowels of the vessel, and electric elevators lift you from deck to deck at your pleasure. Your state room is warmed or cooled by electricity as well as scientifically illuminated with lights from invisible sources. Your meals are cooked by means of electric energy and carried from the kitchen to the dining room by the same force. In fair weather and foul, you may work or play, eat and sleep, be amply entertained or peacefully rested on board of one of these great modern steamships, and all the time you are being swiftly and comfortably carried to your destination. It has been the tireless spirit of progress, working on time and possibly overtime that has wrought this marvelous change.

Invading the Air

But progress is still moving forward and we are now launched upon a new era of transportation which bids fair eventually to revolutionize other means of travel. Air travel had been well started before the great war began—but the experiences and necessities of the four years' struggle advanced air transportation twenty years ahead of what it would have been under peaceful development. Mail and passenger services in a limited sense are already in regular operation in many countries. A printed notice is posted in the office of one of the largest hotels in Chicago which reads, "The aerial mail for New York leaves here daily at 8:45 a. m." Such a notice is now read in a matter of fact manner by the hotel guests. More extensive trips, even transcontinental routes are now being planned for aerial travel—and before long trans-oceanic service for mail and passengers will be in effect over many seas. This new method of transportation will produce many changes in our methods of living. Possibly those of us who are "going up" will soon begin to discard surplus apparel, and even turn our pocket money into greenbacks, in order to cut down the weight. Those of us who stay down will probably require to carry as much accident insurance as those who fly, for we will never know what may strike us when we leave our homes. Only as far back as yesterday, all we had to look out for, when we ventured abroad, was the automobile, the bill collector, the trolley, the truck, the hansom cab, the taxi, the bicyclist, the switch engine, the gentleman who carried his umbrella under his arm with the ferrule pointing to a quarter past three, and the lady who walked one direction and looked another. That was all. But today, we not only have to look out for all those possibilities with our eyesight, but we have to keep part of it aimed at the sky above, for southbound aeronauts, whose little aeroplanes have failed to aero properly.

Without the inventions of two great men, rapidity and safety in railway traveling would have been impossible. These men were George Westinghouse, the inventor of the air-brake, and Professor Morse, the inventor of the practical method of telegraphy. Sometimes a big man fails to recognize the spirit of progress when it hunts him up. When Westinghouse was ready to exhibit a model of his air-brake, he sent a letter concerning it to Commodore Vanderbilt, the then leading railroad man in the country. Vanderbilt smiled at the idea of stopping a train with wind, and wrote at the foot of Westinghouse's letter, "I have no time to waste on damn fools"—C. Vanderbilt. Later Westinghouse made a similar

The earliest form of transportation made use of by the human was the strength of his own muscles. Today the aeroplane brings distant cities close together and gives man the use of the great unobstructed spaces of the air.

request to President Cassett of the Pennsylvania Railroad. Cassett listened and gave Westinghouse a chance to demonstrate, with the result that the railroad world was startled. Vanderbilt heard of the experience and wrote to Westinghouse to call and explain the device. It is said Westinghouse returned the letter and across the bottom was written, "I have no time to waste on damn fools."—G. Westinghouse.

Development of Telegraphy

A story is told of one of the early experiments in telegraphy. For this experiment twenty-six wires were required from one point to another and at each end of each wire was attached a pig—each pig representing a letter of the alphabet. The current sent over a wire caused one of the pigs to squeal, and the receiver of the message knew that squeal called for a certain letter. It would seem as if the progressive spirit has done some good work since that first experiment. By and by a code system was worked out and a message could then be sent one way at a time on a metallic circuit. Then someone stumbled onto the fact that if the ends of the wires were stuck in the ground, one wire would do as well as two—in other words, the grounded circuit was put into effect. Then new inventions were added to new inventions, and instead of one message one way on one line at one time, we have a multiplicity of messages each way on the same wire. That was progress in itself—enough for an ordinary century—but not enough for us. Marconi and others said, "Why all this waste of wires?" "Why all those forests of poles?" And lo, wireless telegraphy was born. Every man has his own opinion as to the marvels of the period he lives in—but no matter what else the

spirit of progress has developed during recent years, there can be no greater wonderment than the wireless message. To the uninitiated, it may seem reasonable that a sound or a flash can be transmitted over a wire—but to send and receive recognizable messages through unlimited, boundless space makes a staggering impression upon the ordinary man with average intellect.

Away back at the time when the telegraph and cable were the most wonderful things in the world, a young man was desperately busy in a noisy machine shop in Boston. He was wholly absorbed in what appeared to be an absurd looking toy. For three years he was toiling over it, and then on a hot June day in 1875 an almost inaudible sound—a faint twang—came from the machine itself. That twang of a spring was the first tiny cry of the new-born telephone, as feeble and helpless as any other baby and "with no language but a cry." That young man was Alexander Graham Bell, and that baby of his, has grown until it is one of the greatest necessities of modern life. When it was patented, there was no name for it in the world's languages, and its description called for "an improvement in telegraphy." It is a pretty young child who would not know today that it is nothing of the kind. It is as different from the telegraph as the eloquence of the orator is from the language of the deaf-mute.

The progressive spirit is working. The wireless telegram has become an important servant in peace and in war. The wireless telephone is coming, and doubtless will be here upon a commercial basis in the not distant future. We may yet see the day when every man will be his own "central" and with a pocket telephone, he may be able to talk to whom he pleases at his own sweet will. The line then will never be busy, and the war tax on such messages will be hard to collect.

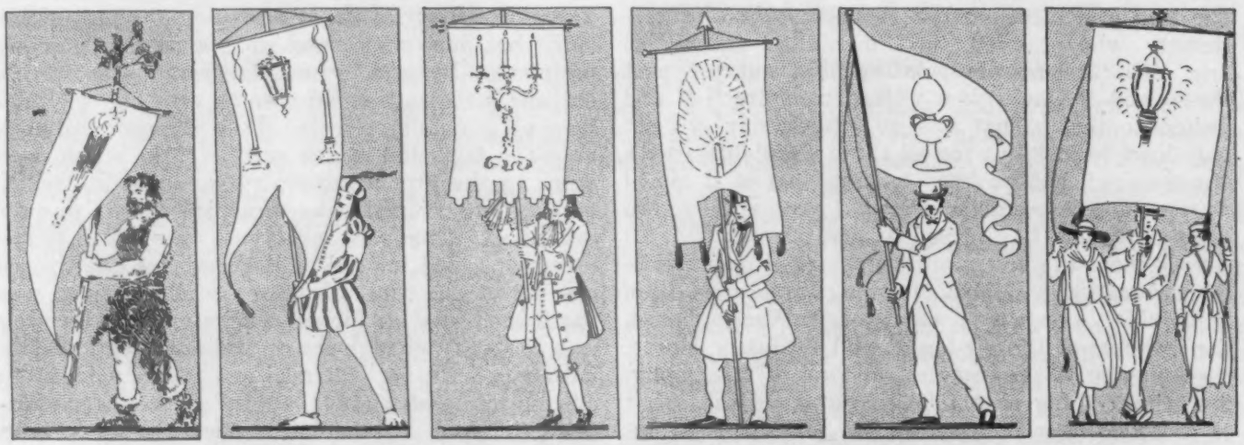
In front of the beautiful Union Railway station in Washington, D. C., there is this inscription:

"Electricity, carrier of Light and Power
Devourer of Time and Space;
Bearer of human speech over land and sea,
Greatest servant of man—itself unknown."

We are told that there is invested in the electrical business in the United States nearly four billions of dollars, and that this large investment has been piled up during the past thirty-five years. Thirty-five years ago, electric lighting was a marvel; today it is in nearly every home where the service is available. Almost every day sees some new application of electricity, which adds to our personal comfort, or to the easier or more economic transaction of business.

More Light

The progressive spirit is perhaps more marked in lighting matters than in many of the every-day necessities we think are ours by right. Our original human ancestor, as far as history informs us, was the cave man. As his name indicates, this progenitor of ours lived in a cave—mostly because he did not know what else to do about a home. His activity was much along the same lines as other animals. He arose with sun and retired at sunset, and had no artificial light at his command. He lived on roots, berries and raw flesh. He did not have to hunt for a cook, because he had no fire and no food that needed preparation. After all, his life was not without some compensations. Then one day he accidentally struck a piece of flint and a spark arrived. From that spark our business started. The cave man was soon staying out at night, and his wife awaited his return with a pine torch to illuminate his cave and some meat stewing in a kettle over a fire. Then, by and by, grease commenced hanging around that kettle, which would drip into the fire, and somehow the successors to the cave man got this grease hitched into a rope and the tallow dip was born, with an illuminating capacity of one candle power. It took centuries to progress, and eventually we got the oil lamp—then artificial gas, and by that time it was thought all that was good in lighting had been discovered. The world sat back contented with its illumination until about thirty-five years ago—and then a crude method of electric lighting was made commercially possible. Altogether there have been issued by the authorities in Washington more than 58,000 patents on electrical subjects, a large percentage of which are in reference to lighting mat-



The evolution of lighting, from the pine torch of the cave man to the brilliant electric lamp of the twentieth century, has proceeded side by side with the development of civilization.

ters. The Department of Commerce and Labor is the authority for the statement that the United States uses more electrical energy than any three countries in the world, and is the most brilliantly lighted nation on the face of the earth. Between the Atlantic and the Pacific and the Gulf and the Great Lakes, there are in use over one hundred million incandescent lamps. If these millions of lamps could be concentrated in one spot, their resplendence would probably equal one of the lesser orbs of the solar system.

It is not an unusual thing to hear some electrical engineer say, especially among the ranks of the younger men, "So much has been done in electrical inventions there remains so little to accomplish," or words with a similar meaning. A few years ago Thomas A. Edison, the man who has himself taken out over 700 patents on electrical subjects, used these words: "We have just started on our electrical way, and the chances of big, new electrical inventions are much greater than before the telegraph, the telephone, the electric light and the electric motor were invented." There is plenty of food for thought in these words, and plenty of encouragement for all present and future electrical engineers in America. It wouldn't seem unreasonable for a live engineer to be worried because the progressive spirit seems to be crawling along so slowly. Look for instance at the one subject of efficiency in the generation of electricity. The definition of efficiency is "the ratio of useful work for energy expended." Think of it! In the most modern electric lamp, there is an average of about five per cent of the latent power in the oil burned, or the water force used in the distant power house. Ninety-five per cent is wasted, dissipated and lost between the oil tank or intake, and the tungsten or gas filled lamp. Were every bit of the energy stored in the oil or the head of water made available when a switch were turned, the light would spring into fifty lamps instead of into one as is the case today. It is true we look upon the tungsten and other modern lamps as far ahead of the carbon filament types. So they are, but consider how little of the energy as represented in the oil or falling water is given back in these newer lamps. One inventor speaks of the incandescent and arc lamps as "simply refinements of the torch of the primeval savage, or the common candle, and primitive and inefficient in their present form." If such is the case, there is plenty of opportunity for the progressive spirit. When we get all that should be gotten of the latent power, we will have wondrous improvements and use for light. "Give us more light" is the cry in all parts of the land. "Give us the cheerfulness and protection which light brings." All country roads must eventually be lined with electric lamps, and as for the cities, they will yet be as bright at night as the highways on a June evening in the land of the midnight sun. Greater efficiency in production is all we need, and this must come through the efforts of the engineer. However, the generation and distribution of electric energy is not the only instance of low efficiency. There are many problems just as important along other lines—awaiting new inventions and better methods—awaiting the touch of the spirit of progress.

Limitless Opportunity

All electrical men, it appears, are not engineers, and there is much work laid out for others in the industry along distinctly progressive lines. Those who sell the product of the generating plants have still a task which needs careful study and constant effort. For a long time, engineers have drummed into the commercial men the necessity of protecting the peak. Metaphorically speaking, both engineers and salesmen were wont to stand with their heads back and faces upward, gazing at the marvelous height of some imaginary peak, and wonder when it will stop climbing in that spire-like style. But times are changing—the peak bug-a-boo is coming into its inheritance, and the progressive spirit has already given it some early payments—in the back of the neck. Two things are contributing to the peak's diminishing importance—the one is the storage of water, making power available at such hours as it may be most needed, and the other is diversity of load. The larger the average central station becomes, the more territory supplied with service—the greater should be the diversity in the connected load. And with the diversified demand, the load factor should improve, and instead of the engineers worrying about peak, that is, the number of kilowatts of daily or yearly maximum demand, the worry becomes changed into anxiety concerning the generation and delivery of the number of kilowatt hours needed to meet the requirements of consumers. With the greater diversity of added load, spread over longer hours of use, business with poor load factor, which was once considered unprofitable, may be taken on with advantage, and business with high load factor, while always desirable, is not as important as it once was to the large central station plant. But the load factor of the central station plant itself may yet be so scientifically increased that the peak will almost entirely disappear. It is not unreasonable to expect that a 90 per cent load factor may one day be a reality. But there is much work to do before the load curve nears the appearance of a straight line—before the electrical consumption of a territory supplied has reached a point approaching saturation. There are many present uses for electricity which are not nearly developed. There are many uses coming of which we may only dream of today. The factories and workshops are eagerly calling for the money saving power. How about all the business to be obtained on the farms? The stores and office buildings are asking what else we can give them. How about the homes? Some will say "Why, look at what we have done in that direction!" Well, what do we see? Electric lighting everywhere—but not enough and not used for long enough hours. Maybe one or two appliances in the average home, just to show how useful they can be. But look at all the drudgery in the home which may yet be relieved. Look at the tired women and weary men who are wearing themselves out because they do not know where to turn for assistance. And all the time we have the servant to do their

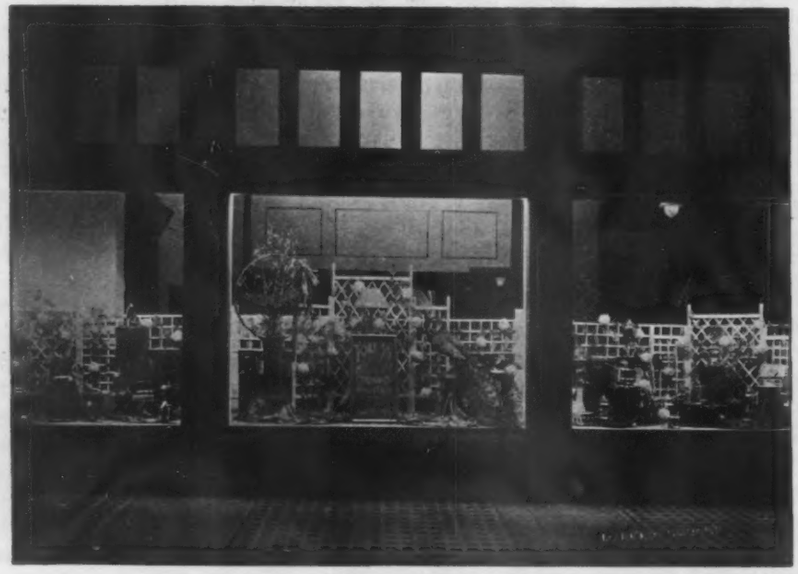
work, but they don't know it. It is someone's mission to teach them—to point the way to rest, ease and comfort and incidentally to raise the consumption of the central station over all hours of the day, and bury the peak forever.

From the Cradle to the Grave

There is no denying the fact, however, that this spirit of progress is running parallel with the strenuous life. There was a time when a man entered his own home, he might expect a certain amount of peace and quiet. Maybe that time has gone never to return. The era of electric appliances is with us, and from the moment we enter our houses, even until the instant we leave them, we are butting into some current consuming device. It takes a pilot to keep clear of cords and wires attached to irons, toasters, curling tongs, foot-warmers, vibrators, hair-dryers and automatic pianos, and if the cords are passed in safety, one's fingers are liable to be burned by handling some innocent looking article which in reality is as hot as blazes. Times are changing. A little while ago, electricity was a toy that doctors and children played with. Now we cannot get along without it. From the cradle to the grave it stays close to us. If there were only some way to blow it out, it would give complete satisfaction in every direction. The modern infant has his milk warmed by it. Growing up he may wear an electric belt for what ails him, and have his diseases and pants pressed with an electric iron. His food may be cooked electrically, and he may be run over by an electric car, carried in an electric hearse to the cemetery and there electrically incinerated. We cannot tell to what uses electricity may be put in the next world, but there is an idea prevalent that a properly constructed halo must be made of a short circuit.

The progressive spirit is evidenced not only in manufacturing and selling the product, but also in seeing that the consumer gets all that he should in the way of attention and education, which will make the service most beneficial, satisfactory and agreeable. The man who can install an electric motor in place of a steam engine has made progress, but not more than the man who can show a customer where he can make two horsepower of energy do the work of three. The man who can induce a customer to burn two lamps where he had only one before, has made progress, but not more than the man who by scientific distribution of light can show a customer how he can make five lamps do the work of ten and have better illumination. The man who can make a customer understand the importance and usefulness of his company in a community, has shown the progressive spirit, but not to a greater extent than the man who has made a customer believe in his company's integrity and its sincere desire to serve the people.

After all, the spirit of progress is entirely a personal matter. We speak of a progressive city, when we really mean the citizens who live within its borders. We speak of a progressive company, when we really mean the men who guide its course and control its management. We speak of a progressive individual, and we mean just what we say. What we need is the ability to recognize progress when it comes, then to get behind it and help it along. There are times when some people don't or won't recognize the working of the spirit of progress, because its coming may look like inconvenience or injury to their business. In the constant evolution from one stage to another, there must be re-adjustments which will disarrange the old order of things. We had better make up our minds to accept the changes, even if they temporarily hurt us—for we cannot stop progress. Every man connected with the electrical industry holds a mandate which should compel him to welcome every forward movement, so that all may recognize that the spirit of progress is the twin sister of electricity — the Goddess of the Wires.



The Salem Electric Company, organized some six years ago in Salem, Ore., does a general electrical merchandising and contracting business. They have just installed a complete electric laundry and every Saturday the public is invited to witness a demonstration of actual handling of a washing in this up to date establishment.

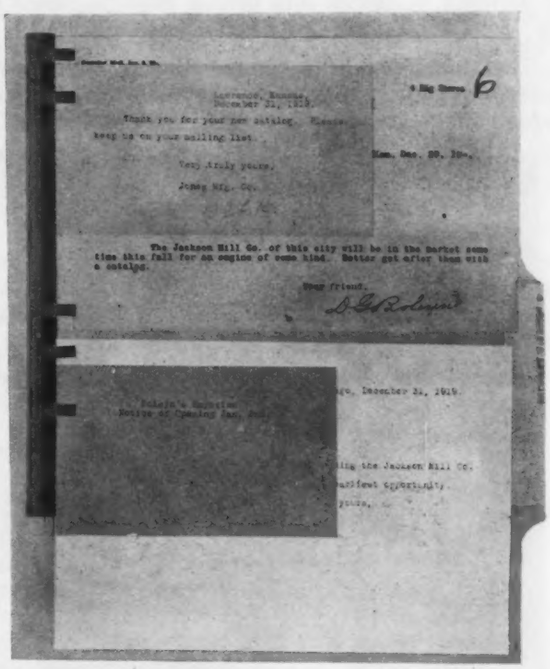
Office Records—Their Filing and Indexing

BY IRENE WARREN

(Can you find things in your files? Modern methods and modern equipment have brought filing to a very high stage of efficiency, and the Director of the Chicago School of Filing and Indexing is writing a series of helpful articles for the Journal of Electricity, analyzing the most effective systems of arranging and using business files.—The Editor.)

This short account of "Filing and Indexing" will be based on correspondence files, but many other records are filed and indexed in similar style.

In times past various methods of putting away correspondence have been tried, such as binding letters in books, putting them in boxes carefully labeled and placed on shelves, but the universal method now used, is to place letters upright in folders in vertical cabinets.



U-File-M strips placed in regular folders will take care of irregular sizes of papers and distribute them within the folders so that more papers may be filed in a given drawer.

Division of Correspondence

The correspondence in the average firm readily falls into two groups called the Regular Correspondents and the Miscellaneous Correspondents. The regular correspondent is one who writes a given number of letters, 3, 6, or 10 as may be determined or the one who writes an important letter. The miscellaneous correspondents are those who write the occasional letter up to the number which entitles them to become regular correspondents. The regular correspondent is of sufficient importance to give him a folder with his name on it. The miscellaneous correspondents are grouped alphabetically in folders bearing the same alphabetic letters as the guides.

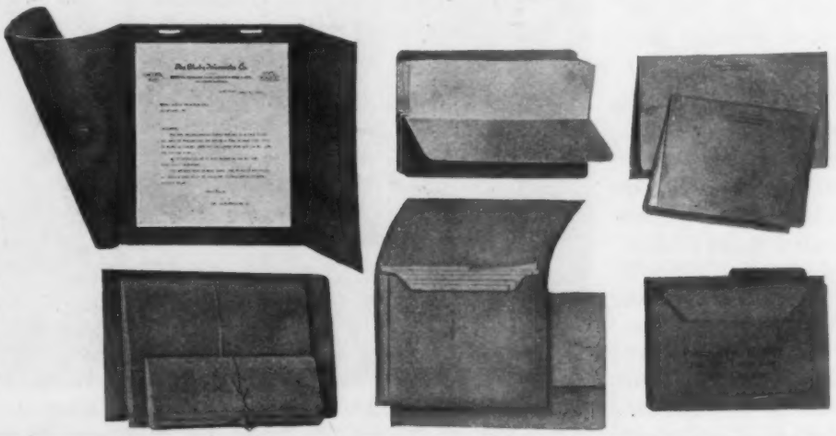
Of making folders there is no end, they are of all shapes and kinds that will fit in a cabinet. The best regular correspondence folder has a reinforced tab, and is made of a tough manila paper.

The miscellaneous correspondents are grouped in tab folders, with the tab cut in another position, and there is one miscellaneous tab folder for each guide in all systems based on the alphabetic arrangement. It is always filed back of the regular correspondents' folders in each alphabetic section.

It is advisable to bring all papers together that can be practically operated together and that is usually many more than most firms have filed together. The idea is to have only one place to look. If necessary, because of the nature of the material, different kinds of folders may be inserted in one scheme, or different colored labels may be used on the tabs.

Accessories for Filing

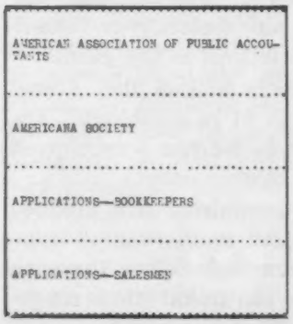
For all systems, except the numeric, gummed labels have been found more convenient. They come in strips of ten labels, one hundred strips in a box. They are typewritten and pasted on to the folder. There are about ten good colors, and a rough classification of materials may thus be made in a file, folders standing back of each other in a given order



Various kinds of folders are shown here—those with sides open or closed, with or without tabs, those for papers that must be fastened together and those where papers are laid in loosely, those with long flaps and those with short flaps. Every file has some irregular papers and these may be well taken care of by inserting the right kind of special folder and marking it with the same kind of label as is used in the general file.

Smith, Brown & Jones Co.
(white label, correspondence)
Smith, Brown & Jones Co.
(pink label for invoices)
Smith, Brown & Jones Co.
(blue label for orders)

The best guides are made of strong press board, with good size tabs projecting well above the folders. These should have tabs in the first two or three positions on the left, the tab of the miscellaneous correspondence following, and the tab of the regular correspondence to the right of these leaving a free space between the miscellaneous and the regular correspondents' folder or at the extreme right for any special guides that are needed. The order of placing



Strip of labels ready to be cut and pasted on regular correspondents' folders. The reverse side of the strip is gummed, and the titles are typed as required.

these in the file is: (1) guide, (2) regular correspondent tab folder, (3) miscellaneous correspondent tab folder. The letters and figures on the guides should be large, in clear bold type, and covered with celluloid. Metal tipped guides are necessary if heavy materials are placed in the files.

Arrangement of Cabinets

The cabinets may be placed around the walls, or in alcove arrangement back to back. A three-foot aisle is necessary between cabinets but five feet or more is preferable. All furniture should be so carefully placed in the room that there are no unnecessary steps taken, that the best light is secured, and the best supervision may be given the room. The sorters, desks, chairs, table for borrowers and all other equipment should be carefully planned and the room made as attractive as possible as it is primarily a department for service.

If necessary, the transfer cabinets for the old files, which are of the same size but of cheaper construction and material, may be placed eight or twelve drawers high and a suspension ladder used.

The equipment and supplies should be regarded as tools for the filing department, and the better they are the better the results. Great care should be used in selection and adapting them to the needs of the firm, in keeping them in good repair, and in being alert to buy new supplies and devices that will make for more efficient work. It is well to be on the mailing list of all the best firms furnishing supplies and equipment, to read carefully the journals that deal with such subjects, such as Printers' Ink, and System, and to attend the best exhibits of business systems and devices.

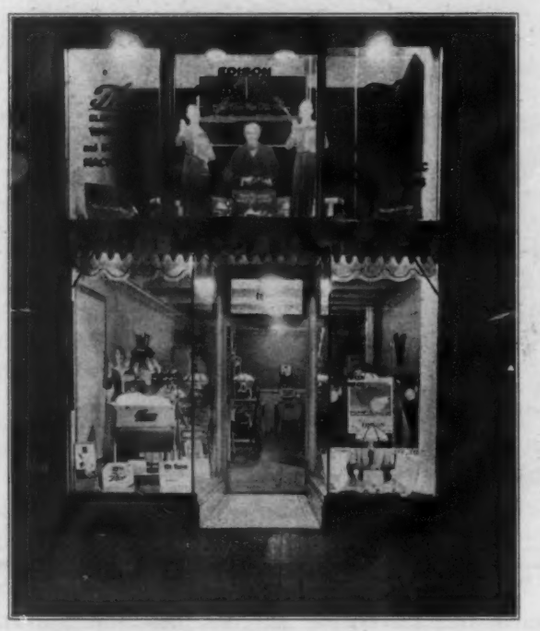
BUILDING A RETAIL BUSINESS

Starting with lamps as the entering wedge the Smith McCoy Electric Company of Portland have developed an electrical retail business which can boast of selling washing machines at the rate of five a day.

Originally no washing machines were handled at all, attention being concentrated almost entirely upon lamps. Solicitors were employed who brought up returns on lamp sales to over $700 by the end of the first week.

At present the store specializes in both lamps and washing machines and does a brisk business in both.

The store occupies a comparatively small space, but the carefully arranged interior and the effective windows make it both distinctive and attractive.



The windows give a view of the interior of the shop as well as serving the usual purpose of displaying appliances. Note the upper window display and the Mazda girls, featuring lamps.

A homelike interior with no overcrowding gives distinction to this store. Jewelers' cases are becoming very popular with electrical retailers for the display of appliances.

Essentials of Esperanto

BY W. R. DAINGERFIELD

(Considerable impetus has been given of late to the idea of a common commercial language as a means of simplifying international intercourse. The suitability of Esperanto for this purpose is evidenced by the brief grammar now appearing in these pages.—The Editor.)

35. Mi konas Johanon. En Esperanto kaj tre multaj lingvoj du verboj reprezentataj de "scii" kaj "koni" estas uzataj tie, kie en la angla ni uzas unu solan verbon "to know (tu no)." La verbo "scii" povas preni ke-frazeton, kiel: "Mi scias, ke mia Savonto vivas." "Koni" prenas nur ordinaran akuzativaĵon.

36. Donu al la birdoj akvon. Ne estas devige enmeti vorton signifantan nedifinan kvanton, kiel la anglan "some (sŭmm)," sed tio estus farebla jene: Donu al la birdoj iom da akvo. "Iom" estas adverbo, uzata kiel substantivo, kaj signifas kelkan aŭ ian nedifinan kvanton. "Da" (**of**, ov) estas prepozicio uzata post vorto de mezurado kaj antaŭ la mezurata materialo: Taso da kafo, tavolo da antaŭjuĝo. Se oni volas individuigi la vorton antaŭ aŭ post la "da," oni devas uzi "de": Glaso **da** vino estas kvanto da vino proksimume mezurebla per plena vinglaso. Glaso **de** vino estas glaso por vino, aŭ glaso enhavinta vinon, aŭ vinglaso mem. Funto da teo estas kvanto da teo; sed ni devas diri: "Vendu al mi funton **de** tia teo, kian mi aĉetis antaŭhieraŭ." Oni ne diras "da la," ĉar la "la" individuigas.

37. Bonan matenon! Salutoj kaj similaj esprimoj ofte estas partoj de frazoj, kaj do la nomvortoj kaj adjektivoj prenas kazon saman, kiel tiun, kiun ili prenus en la plenigita frazo, jene: "Mi deziras al vi bonan matenon!"

38. Via pano estas malpli freŝa, ol mia. La prefikso "mal-" renversas la sencon de la radiko. "Pli" signifas la anglan **more** (mor), tial "malpli" signifas **less.** La vorto maligita estas pli forta ol la kunresponda nea vorto, kaj ne estas sinonima al tiu ĉi, escepte nur en tiuj okazoj, en kiuj nacia lingvo havas alian radikon por esprimi nean sencon de la unua radiko. Komparu: bona, good (gud); nebona, not good, kio estas eble ankaŭ ne malbona; malbona, bad (badd). En la angla lingvo ni havas "same," "not the same," "different"; sama, nesama, malsama; kvankam laŭsence la ideo **different** estas idente tiu de "nesama," tamen estas konvene kaj oportune havi la vorton "malsama" por traduki la anglan vorton "different."

39. Ol mia. En la frazo laste supre skribita la vorto "mia" estas uzata por "mia pano," kaj tradukiĝas per "mine (majn)." La komo, kiu estas antaŭ la kunjunkcio "ol, than (thann)," ne estas deviga, sed la plimulto de presistoj apartigas per komoj frazerojn komenciĝintajn per konjunkcio aŭ per **kiu, kiam,** kaj similaj k-vortoj, aŭ per adverba participo finiĝinta per **-e** kaj aludanta la subjekton.

40. El ĉiuj siaj fratoj Antono estas la malplej saĝa. En la angla tiu ĉi frazformo estus malĝusta, pro tio, ke Antono ne estas unu el siaj fratoj, sed en Esperanto kaj multaj aliaj lingvoj ĝi estas ĝusta.

35. "I know (am acquainted with) John." In Esperanto and very many languages two verbs represented by "scii" and "koni" are used where in English we use but one verb, "to know." The verb "scii" may take a "ke"-clause; as, "I know that my Redeemer liveth." "Koni" takes an ordinary accusative only.

36. "Give (to) the birds water." It is not necessary to insert a word meaning an indefinite quantity like the English "some," but it could be done, thus: Donu al la birdoj iom da akvo. **Iom** is an adverb used as a noun, and means some or some kind of indefinite quantity. "Da" (of) is a preposition, used after a word of measurement and before the name of the material measured: A cup of (da) coffee, a layer of (da) prejudice. If we wish to individualize the word before or after the **"da"** we must use **"de."** A glass "da" wine is a quantity of wine approximately measurable by a full wine-glass. A glass "de" wine is a glass for wine or a glass that contained wine, or is a wineglass. A pound of tea is a quantity or weight **da** tea, but we must say, "Sell me a pound **de** the kind of tea I bought day before yesterday." "Da la" is not used, for the reason that the "la" individualizes.

37. "Good morning!" Salutations and similar expressions often are parts of sentences, and accordingly the nouns and adjectives take the same case that they would take in the completed sentence, thus: "I desire unto you a good morning!"

38. "Your bread is less fresh than mine." The prefix "mal-" reverses the meaning of the radical. "Pli" means "more," so "malpli" means "less." The word whose meaning is reversed is stronger than the corresponding negative word, and is not synonymous with it, except when a national language has another radical to express the negative sense of the first radical. Compare **bona,** good; **nebona,** not good (which perhaps is also not bad); **malbona,** bad. In English we have "same, not the same, different," **—sama, nesama, malsama.** While in meaning the idea "different" is identically that of "nesama," nevertheless it is conventional and handy to have the word "malsama" to translate the English word "different."

39. **"Ol mia,"** than mine. In the sentence last above written, the word **mia** (my) is used for **mia pano** (my bread), and is translated by "mine." The comma that stands before the conjunction **ol** is not compulsory, but most printers separate by commas parts of sentences beginning with a conjunction or with "who, which, that, when," and similar **k**-words, or with an adverbial participle in **-e** alluding to the subject.

40. "Of (out of) all his brothers Anthony is the least wise." In English this form of sentence would be incorrect, because Anthony is not one of his own brothers, but in Esperanto and many other languages it is correct.

SPARKS—Current Facts, Figures and Fancy

(How long can you keep milk? How many times a year do you talk over the telephone? How many miles do you travel by elevator? We don't know, but we have collected a great deal of information on what other people do about it. Among interesting new inventions also recorded here is a labor-saving device for the preservation of the railroad conductor.—The Editor.)

Several companies have been organized in Japan to produce oxygen by electrolytic separation of water.

* * *

More people ride vertically than horizontally in Manhattan. Statistics show that the elevators carry more than 10,000,000 passengers daily, a number exceeding the number of passengers carried by all the surface, elevated and subway cars.

* * *

One of the wonders of a recent British exhibition was a Danish appliance for keeping milk fresh for two years or more. It is said that cream bottled in May was found to be excellent in October. No preservatives are used. The preserving force is a pressure of 2,000 pounds to the square inch.

* * *

A new and powerful electrically driven winding engine has just been brought into use by an English coal company. The engine is capable of raising 150 tons per hour from a vertical depth of 900 feet. It is fitted with safety appliances which control the travel of the cage, and the most modern signaling apparatus has been provided.

* * *

An English engineer has succeeded in extracting alcohol and its derivatives from coke-oven gas on a commercial scale. If applied to the whole of the coal carbonized in Britain, the process was estimated to yield 50,000,000 gallons of motor spirit a year, and would revolutionize the position of the country in regard to the supply of liquid fuel.

* * *

Although ranking twelfth in population, California stands fifth in the number of personal income tax returns filed in 1917, and sixth in the total net income reported by personal returns. Of the 182,232 persons filing income tax returns for the year 1917, six showed incomes in excess of $500,000 per annum. 176 persons admitted receiving incomes during the year of upwards of $100,000.

* * *

British inventors have made a screen similar to the German invention which will reproduce pictures in daylight or in a brightly lighted room as clearly and distinctly as those now shown in a darkened theater. This invention, known as the "Q. E. D. daylight cinematograph screen," is said to have been completely successful in a recent public demonstration. According to one of the patentees, the picture is projected from behind onto the screen which is made of a very translucent material. He believes that the invention will prove invaluable for educational purposes, as it enables pictures to be shown in a school or lecture room in broad daylight.

* * *

Five hundred exposures a second is the record in film photography made by two French scientists. They used electric sparks emitted by a special apparatus, and were able to take a detailed and accurate kinematograph record of the track of a revolver bullet. The cone of gas leaving the barrel before the bullet itself was clearly visible, and the track of the bullet could be followed. Scientists forecast that this invention will enable accurate photographs to be taken of every form of movement in the human organism.

* * *

A London railroad has arranged to put into operation on its system an electrical device whereby the names of stations are indicated in the passenger cars. The system is operated by illuminating sections of the ceilings of each compartment, arranged in panels, each of which in turn becomes prominently lighted up as the journey proceeds. At the commencement of the journey the next station becomes so indicated; when that point has been left, the section or panel applying to it becomes dull, but the next becomes illuminated. Before starting a journey the motorman actuates a series of switches, and the rest of the action is automatic, the mechanism being operated by a small striker on the track between the stations. In addition to the names of the stations, it is intended to show a map of a square mile of streets around each spot, giving the chief shopping centers and places of amusement.

* * *

According to the report showing the results of the census of telephones covering the year 1917, there are 53,234 separate telephone systems and lines in the United States. These lines and systems operated 28,827,188 miles of wire in the United States—enough to girdle the earth at the equator 1,153 times—and connected 11,716,520 telephones and 21,175 public exchanges. The messages or "talks" sent over these wires aggregated the stupendous total of nearly 22 billion, or, to be exact, 21,845,722,335. Figured on the estimated population of the country in 1917 this gives 211 messages per annum to every man, woman, and child. The industry in 1917 gave employment to 262,629 persons, of whom 171,119, or over 65 per cent, were women. The sum paid out in salaries and wages amounted to $175,670,449. These employees operated plants and equipment valued at $1,492,329,015, which yielded operating and nonoperating revenues of $391,499,531.

PERSONALS

H. F. Jackson, president and general manager of the Sierra & San Francisco Power Company, prior to its recent amalgamation with the Pacific Gas & Electric Company, has been made a vice-president of the latter company and becomes assistant general manager in charge of electrical construction. This new announcement means much to the electrical industry in the West. Mr. Jackson is known affectionately to the industry as "Captain" Jackson. He came prominently before the industry some years ago when at the first convention of the Pacific Coast Section, N. E. L. A., in Riverside during April, 1917, he was elected president of the Pacific Coast Section. It was at this interesting period that the California Electrical Cooperative Campaign was launched and later during the war period, due to his official position with the Section, he rendered able work for the industry in the West in the matter of conservation of power energy. The result of this work was that the three great hydroelectric systems serving San Francisco were inter-connected and the energy output pooled under a Power Administrator appointed by the California Railroad Commission. At the convention at Del Monte during the war period, which proved to be truly a war convention, other matters of great practical importance to the Federal Government were taken up and discussed and put through in a spirit of great helpfulness that rendered much credit to the industry on the Pacific Coast. Captain Jackson has the reputation as an able engineer along the line of electrical construction and those who go back over the past decade and review in mind the accomplishments of the Sierra and San Francisco Power Company in the building of its Stanislaus project cannot help but feel that the Pacific Gas & Electric Company, in its new reorganization, will feel his helpful influence on many an occasion.

H. A. Barre, electrical engineer for the Southern California Edison Company, is a recent San Francisco visitor.

George Garrett has been appointed city engineer of La Grande, Oregon.

D. C. Henny, consulting engineer of Portland, Ore., has been made one of the directors of the American Society of Civil Engineers.

A. Turnbull, northwest representative of the Edison Electric Appliance Company, has returned to Seattle after a month's visit to Portland.

John W. Nicol, mining engineer, spoke before the Engineers' Club of San Francisco on January 22nd on "Some Problems in the Mexican Situation."

John M. Gregory has been appointed Executive Secretary of the East Bay Electrical Trades Association, with headquarters at 518 Pacific Building, Oakland, California.

F. J. Early, secretary and treasurer of the Nevada Valleys Power Company, Lovelocks, Nevada, was a guest at the San Francisco Electrical Development League luncheon, January 19th.

Arthur Baldwin, senior vice-president of the McGraw-Hill Co., owners of the Journal of Electricity, is a recent San Francisco visitor and is now en route to his home office in New York City.

M. C. Hixson and **W. E. Camp** are joint authors of a useful illustrated pamphlet, issued by the General Electric Company, entitled "Electrically Operated Irrigation Plants, for the State of California."

J. W. Perry, general manager of Electrical and Auto-Motive Equipment of the H. W. Johns-Manville Company, New York, **B. C. McClure,** general manager of the Insulation and Power department, **J. M. Berdan,** general manager of the Building and Roofing department, and **L. R. Hoff,** general sales manager, all of the above company, are on the Pacific Coast attending the annual sales conference of the Pacific Coast division.

A. H. Griswold, plant engineer for the Pacific Telephone & Telegraph Company, has recently returned to San Francisco from France, where he went to install some important telephone work for the Western Electric Company. It will be recalled that Mr. Griswold returned again to France shortly after the Armistice signing, where he had previously in charge, as a lieutenant-colonel of the Signal Corps, all of the communications back of the trenches for the Allied forces.

B. Badrian and **R. G. Chamberlain,** the district managers respectively of the San Francisco and Seattle districts for the Hurley Machine Company, have just returned from Chicago where a conference of "Thor" district managers and store managers has just been held. Much enthusiasm was generated at the conference due to the broad vision of Neil Hurley and E. N. Hurley, well-known national figures, which impressed itself upon all present in regard to the business possibilities immediately ahead in the nation.

A. S. Kalenborn, chief electrical engineer and superintendent of power for the Cerro de Pasco Mining Company of Cerro de Pasco, Peru, has returned to San Francisco after two years' absence in South America. Mr. Kalenborn is contemplating remaining in this country and entering the field of consulting engineering. It will be recalled that prior to Mr. Kalenborn's going to South America he was chief engineer of the San Joaquin Light & Power Corporation. He comes back with a host of experience and interesting information concerning the great republic to the south, and in his work in South America he had the distinction of operating the plant located at the highest altitude of any hydroelectric plant in the world, being at an elevation of 12,500 ft. above sea level.

Captain R. W. A. Brewer, who until recently was a captain in the British Army, detailed to the Pacific Coast for the inspection of munitions, and who later became a consulting engineer with headquarters in San Francisco, has now accepted a permanent position as consulting engineer for a large automobile manufacturing concern situated in Cleveland, Ohio. Capt. Brewer has contributed a number of helpful articles to the Journal of Electricity on various subjects. In this issue may be found an able article on the vacuum valve for radio work, that came under his inspection during the war. Other discussions have been on the subject of fuel and its application and economy in steam power plant generation. Mr. Brewer is recognized as one of our ablest technicians in the carburization of gas engine cylinders and all those things which have to do with the theory and design of electrical apparatus, particularly along the line of radio activity and the use of the vacuum valve in wireless telegraphy. The West loses in him one of its ablest engineers and technical writers.

Paul M. Downing, who has been chief engineer of the hydroelectric department of the Pacific Gas & Electric Company for some years, has just been made a vice-president of the Pacific Gas & Electric Company and will be in charge of electrical operation for the company. Mr. Downing has long been recognized as one of the ablest operating engineers of the nation. During the war period he served as manager of operation for the three inter-connected systems of the Pacific Gas & Electric Company, the Sierra and San Francisco Power Company, and the Great Western Power Company. It was during this period that over a billion and a half kilowatt-hours of energy were delivered in one year, which statistics of the nation showed to be the greatest combined output ever delivered by an inter-connected system anywhere in the nation, overtopping even that of the Commonwealth Edison Company of Chicago. The West recognizes in Mr. Downing an able operating engineer and his new promotion is meeting with frank acknowledgment and congratulation on all sides.

Charles L. Eshleman, sales manager of the Union Metal Standards Company, has just completed a trip throughout the Pacific Coast.

T. E. Reed, formerly of the Westinghouse Company, has recently joined the office staff of the Majestic Electric Development Company.

L. A. Somers, managing director of the Coast Equipment Company, San Francisco, has just returned from a ten days' trip through Southern California.

G. R. Brandon, a consulting engineer with the General Combustion Company with headquarters in Chicago, is a recent Los Angeles and San Francisco visitor.

S. I. Shida, chief electrical engineer of the Kiso Electrical and Industrial Company, Japan, is in San Francisco, preparatory to a business tour of the United States.

E. A. West, chief engineer and general superintendent of the Denver Tramways company, who has been spending some time in San Francisco, recently returned to Denver.

Lawrence Chaffee, of the Chaffee Electric Company, Visalia, California, was a guest at the luncheon of the San Francisco Electrical Development League on January 26th.

W. D'A. Ryan has come out from New York to be present at the inauguration of the Broadway Lighting System in Los Angeles. He recently spent a short time in San Francisco.

Captain Addison N. Clark, who has been connected with the Magnavox Company since leaving the service, has resigned his position with that company to become associated with Edison Ltd.

R. H. Ballard, president of the National Electric Light Association, arrived in New York on Jan. 23rd, after stopping over at Salt Lake City, Denver, Omaha, Chicago and Cleveland. Mr. Ballard is expected to arrive back on the Pacific Coast about February 20th.

Chas. E. Gorton, chairman of the American Uniform Boiler Law Society, and a member of the Code Committee of the American Society of Mechanical Engineers, is making a tour of the States to promote the legal adoption of the A. S. M. E. code. Mr. Gorton recently passed through San Francisco.

C. H. Bromley, associate editor of Power, with headquarters in New York City, is a recent Pacific Coast visitor at Seattle, Portland, San Francisco, Los Angeles, and other engineering centers, where he is visiting and collecting data on typical hydroelectric and steam electric power plants.

Kent A. Hawley, a graduate of the University of California, formerly connected with C. C. Moore & Company of San Francisco, and more recently on the electrical zone of the New York, New Haven & Hartford Railroad, is now in charge of the New York office of the Locke Insulator Manufacturing Company of Victor, N. Y.

R. B. Woolley, who has been director of publicity of the Society for Electrical Development, Inc., for the past two years, is now with Thos. F. Logan, Inc., Advertising Agency, New York City. Mr. Woolley, who has been seventeen years in sales and advertising capacities, joined the agency after service overseas. He will specialize on electrical and merchandising accounts.

Roy J. Heffner, chairman of the technical department of the University of California extension division, has returned from a tour of the East where he has been visiting all of the greater universities which incorporate extension divisions in their work. Mr. Heffner plans to utilize the best of the many ideas and suggestions gathered and so continue the University of California in its place of leadership among the great universities of the world.

H. C. Hopkins, of the publicity department of the Westinghouse Electric & Manufacturing Company, is back in San Francisco after an extended trip to the East. Mr. Hopkins spent some time in Pittsburgh getting in touch with the 1920 plans for the publicity organization of his company. In visiting several of the industrial and commercial centers of the East, he made an investigation of business conditions in that section of the country.

Harold D. Sammis, since June, 1913, connected with the California Railroad Commission in various capacities, has resigned to accept the secretaryship of the Public Service Commission of the state of Nevada. The resignation takes effect on the first of February. The appointment is a recognition of the ability displayed by Mr. Sammis in connection with the work of the California Railroad Commission, which is looked upon as a leader in utility regulation.

OBITUARY

Howard Joslyn, for fifteen years city electrician of Seattle, resigning from that position seven months ago, died at his home, Edgewood Farm, across Lake Washington from Seattle, on the morning of January 15. He had been ill for several weeks with pneumonia. Mr. Joslyn was born May 17, 1869, at Crawfordsville, Indiana, where he resided for twenty years. He graduated from Wabash College in 1889, coming to Seattle the same year. Shortly afterward he went to Tacoma as a representative of the Westinghouse Company and subsequently served as city electrician for several years. Returning to Seattle in 1898 as purchasing agent for the Snoqualmie Falls Power Company, in 1904 he became city electrician of Seattle. This position he retained up to last June when he resigned to make his home at Edgewood Farm, a poultry ranch near Bellevue. Mr. Joslyn was a member of the American Institute of Electrical Engineers and of the Pacific Northwest Society of Engineers, being secretary of the latter organization at the time of his death. Mr. Joslyn was well known in electrical engineering circles of the Northwest and enjoyed a large degree of popularity.

Albert W. Bullard, formerly vice-president and general manager of the Great Western Power Company, died suddenly in the East on January 19th.

Meeting Notices for Electrical Men

(An important convention of the California Association of Electrical Contractors and Dealers is a feature of recent activities in electrical circles. Contractor-dealers in the Northwest report interesting meetings, while local sections of engineering societies send in news of many exceptional papers and addresses.—The Editor.)

N. E. L. A. Executive Committee

At a recent meeting of the Executive Committee of the National Electric Light Association certain new points were brought up in committee reports. The Company Sections Committee noted a tendency among companies to form employes' clubs rather than company sections, and recommended the establishment at N. E. L. A. headquarters of a separate bureau for the supervision of Company Section work, the bureau to include men who can travel among the Sections.

In a report on publication work, a statement was made of plans to publish the Rate Research Bulletin and the Rate Book at N. E. L. A. headquarters instead of in Chicago; and slightly to change the character of the N. E. L. A. Bulletin, making it "lighter and more readable."

An extended report was made on the work of coal service to member companies during the strike.

H. H. Aylesworth, executive assistant to the president, suggested the combining of some of the committees now existent in the Association's plan of organization, and the creating of additional ones such as a committee on uniformity in valuation, uniformity in state laws as to regulation, etc.

It was arranged to have frequent conferences between Mr. Wakeman of the Society for Electrical Development, and Mr. Aylesworth, in order to prevent duplication of effort by the two organizations.

San Francisco Section A. I. E. E.

On January 21 the San Francisco Section of the American Institute of Electrical Engineers met with members of the American Institute of Mining Engineers to listen to a paper by B. B. Beckett on "Electricity in the Gold and Silver Mining Industry." The paper covered the subject thoroughly, presenting data of great timely interest.

N. E. L. A. and A. S. M. E., Portland

The regular monthly meeting of the Portland sections of the National Electric Light Association and the American Institute of Electrical Engineers was held at Multnomah Hotel at 8 p.m., Jan. 13, 1920. Professor William Conger Morgan, of Reed College, talked on "The New Theory of Physics" in his own original way. The gathering was co-educational, and dancing and a buffet lunch were enjoyed by more than 100 members and their friends.

A. I. E. E., Seattle Section

The regular January meeting of the Seattle Section of the American Institute of Electrical Engineers was held on Jan. 20, 1919, in the Chamber of Commerce Assembly Room, at 8 p.m. The speaker of the evening was Prof. William Spraragen of the University of Washington, his subject being "Electric Welding of Mild Steel," with special reference to shipbuilding. During the war Professor Spraragen was connected with the National Research Council as Assistant Chairman of the Welding Research Committee. The meeting was preceded by the usual dinner at 6:30 p.m. at the Butler.

Oregon Association of Electrical Contractors and Dealers

At the regular meeting of the First District of the Oregon Association of Electrical Contractors and Dealers, held Monday, January 12, 1920, the following named members were appointed to act as the District Executive Committee for the following year: F. A. Bauman, W. O. Fouch and J. H. Sroufe. The retiring committee was tendered a rising vote of thanks in appreciation of the efficient work accomplished by them during their term of administration.

Mr. Mundt, the secretary, called the attention of the meeting to the fact that the electrical industry had been held up, at a meeting of the Commercial Club, as being conspicuously backward in the matter of employing ex-service men. He mentioned that although practically every firm in the Association had done its share individually, the Association had not acted as an organization and advertised the fact, with the consequent misunderstanding on the part of the Chamber of Commerce. The secretary was instructed to canvass the membership to obtain the information in reference to the number of ex-service men employed and communicate with the Chamber of Commerce.

At a meeting of the Executive Committee for the First District of the Oregon Association of Electrical Contractors and Dealers held Wednesday, January 15th, at the Oregon Grill, Mr. Frank Bauman was elected chairman and the following committees appointed:

Jobbers Committee—J. H. Sroufe, W. O. Fouch, F. A. Bauman, Ed. Pierce, E. L. Knight, A. E. McCoy.
Retail Committee—J. F. Barrett.
Contractors Committee—R. C. Kenney, A. S. Halls.
Membership Committee—R. W. Larsen.
Labor Committee—Frank Pierce, J. R. Davidson.
Price Book Committee—C. P. Scott.
Entertainment Committee—Ed. Pierce, H. H. Fitzpatrick, M. J. Walsh.
Welfare Committee—S. C. Jaggar, R. N. Lewis.

Electrical Supply Jobbers' Association

The Electrical Supply Jobbers' Association of the Pacific Coast announces a meeting to be held at Del Monte, February 26, 27 and 28, 1920.

BUILDERS OF THE WEST — LXX

LEE H. NEWBERT

That the West should have contributed ideals in cooperative helpfulness, equaled nowhere else in the nation today, is a matter for gratification to all those who have followed the interesting intensive development of electrical energy west of the Rockies during the past decade. Not alone has the physical development of hydroelectric network progressed to a degree without equal in other sections of the country, but in the merchandising of the electrical product, in energy and in appliances, a certain something has been added that adds to the profit in the industry, and to a harmonious understanding with the public, that is today being sought as a model for many other sections of our country. To Lee H. Newbert, Chairman of the Advisory Committee of the California Electrical Cooperative Campaign, this issue of the Journal of Electricity is affectionately dedicated for his lasting and enduring work in the establishment of ideals of helpfulness in the West that have made possible these new planes of attainment.

Convention of the California State Association of Electrical Contractors and Dealers

The first 1920 meeting of the California State Association of Electrical Contractors and Dealers was held at Sacramento on January 17th. The gathering was held at the Travelers' Hotel in that city, and was one of the best-attended meetings ever conducted by the State Association. On Saturday morning, January 17th, the State Executive Committee convened, and among other important actions decided to continue its support of the California Electrical Cooperative Campaign, with an increased appropriation of $3600. This decision was unanimously ratified by the entire body at its afternoon session.

The general meeting was called to order by Clyde L. Chamblin, who in assuming his new duties as president of the State Association welcomed the delegates from all sections of California. Mr. Chamblin expressed confidence that with the spirit manifested by the gathering the new year would prove to be the most prosperous in the history of the organization. He emphasized the fact that localism must disappear, and that all must work for the good of the whole, uniting as have other branches of the industry. J. W. Redpath, secretary of the Association, reported on the progress of organization work throughout the state, especially the institution of promising new sections in southern California. Many new applications for membership in the State Association were read and approved. It was agreed that the Advisory Committee of the California Electrical Cooperative Campaign be consulted in regard to possibility of change of representation on that board for the contractor-dealers.

James A. Woods of Sacramento reported on the meeting of the Motor Section, which was held at the luncheon hour, and announced that a permanent organization had been perfected, with himself as chairman, H. N. Nelson as vice-chairman, and Louis R. Ardouin as secretary.

W. D. Kohlwey reported for the Retail Section; Earl E. Browne spoke on the activities of the advisory committee working with the Industrial Accident Commission in the formulation of Safety Orders; and Glen E. Arbogast outlined the extensive advertising campaign which had been conducted in southern California by the dealers during the holiday season. M. L. Scobey, member of the Advisory Committee of the California Electrical Cooperative Campaign, reported that during the coming year the contractor is to be given more attention, pointing out that a special field agent to work among the architects is to be appointed.

Mr. Arbogast showed the gathering the plans for wiring a model bungalow, as published in southern California under his direction, and urged that more of this educational work be carried on. H. H. Courtright of Fresno presented the report for the commercial committee. Reports of conditions in the territories of the various local sections were given, among those that spoke being: C. Osborn, Turlock; R. V. Oyler, Berkeley; John M. Gregory, Oakland; Tom Bennett, San Francisco, Earl E. Browne, San Francisco; J. C. Hobrecht, Sacramento; F. C. Sherman, Rio Vista; W. E. Cox, Santa Cruz; Wm. Blide, Santa Cruz; H. H. Courtright, Fresno; W. H. Gribble, Chico; W. S. Cass, Chico.

D. E. Harris of San Francisco spoke on the importance of contractor-dealers securing membership in the National Electric Light Association. Art Rowe gave an inspirational talk on the necessity of cooperation with the active workers for the good of the industry. "Give flowers to the workers while they are laboring," he urged, "don't wait till they have passed away to show your appreciation."

The banquet in the evening at the Travelers' Hotel was in every way a decided success, 104 being in attendance. Clyde L. Chamblin acted as toastmaster. The first speaker of the evening was Charles G. Johnson, State Superintendent of Weights and Measures, who told in an interesting manner of the work of his department. Lee H. Newbert, chairman of the Advisory Committee of the California Electrical Co-

EXECUTIVE COMMITTEE, 1920, CALIFORNIA STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS
At the first monthly convention, Travelers' Hotel, Sacramento, January 17

Standing, from left to right: F. T. Broiles, Santa Ana; Walter Cox, Santa Cruz; James Woods, Sacramento; W. S. Cass, Chico; E. E. Browne, San Francisco; C. E. Osborn, Turlock; C. B. Kenny, Oakland.

Seated, from left to right: H. H. Courtright, Fresno; G. E. Arbogast, Los Angeles; J. W. Redpath (secretary); C. L. Chamblin (president), San Francisco; W. H. Gribble, Chico; T. J. Bennett, San Francisco; Robert Oyler, Berkeley.

operative Campaign, outlined the activities of that organization from its beginning and showed what it has accomplished for the upbuilding of the contractor-dealers' business. Mr. Newbert also dealt with the problems of the power companies in the development necessary in the next few years, and urged cooperation in the forming of a proper public opinion, which is requisite for the financing of projects now under way.

H. C. Hopkins, of the publicity department of the Westinghouse Electric & Manufacturing Company, gave an interesting account of business conditions in the East as observed by him upon his recent trip. Mr. Hopkins told of the interest of electrical merchandisers in the East as to the practical results of the California Electrical Cooperative Campaign, about which they have all heard, and he advised the contractor-dealer to put "his house in order" so as to meet the critical gaze of vistors who will swarm out to California in May. C. C. Hillis, of the Electric Appliance Company, San Francisco, gave an outline of the problems which today confront the electrical jobber. The only solution to the servant problem, said Mr. Hillis, lies in the extended utilization of electric household appliances.

A telegram from A. E. Wishon, president of the Pacific Coast Section, N. E. L. A., was read. Mr. Wishon sent to the gathering his congratulations, and wished a prosperous year to Mr. Chamblin, the incoming president. In closing the meeting, Mr. Chamblin again thanked those present for their attendance and expressed the opinion that with such hearty support as had been shown throughout the day's proceedings the State Association was bound to have its best year in 1920.

The full list of those present at the banquet is as follows:

Clyde L. Chamblin, California Electrical Construction Co., San Francisco
Lee H. Newbert, manager Commercial Department, Pacific Gas & Electric Company, San Francisco.
Charles G. Johnson, State Superintendent of Weights and Measures, Sacramento.
Howard W. Angus, secretary California Electrical Cooperative Campaign.
J. C. Hobrecht, J. C. Hobrecht Company, Sacramento
Aubrey Drury, Associate Editor, Journal of Electricity
R. M. Alvord, General Electric Company, San Francisco
William H. Gribble, Western Gas & Electric Appliance Co., Chico
H. N. Nelson, Enterprise Electric Works, San Francisco
F. N. Buzzell, Buzzell Electric Works, San Francisco
O. Kurtz, San Francisco
C. J. Newbery, F. E. Newbery Electric Co., San Francisco
M. E. Hickox, Pacific States Electric Co., San Francisco
F. J. Wallace, The Electric Shop, Sacramento
H. J. Holt, Holt Electric Shop, Woodland
L. J. Brown, Western Electric Co., San Francisco
S. H. Curry, Fresno Electric Co., Fresno
C. A. Quilty, Century Electric Co., San Jose
F. S. Thomas, Valley Electrical Supply Co., Fresno
T. D. MacMullen, Majestic Electric Development Co., San Francisco
W. R. Dunbar, Westinghouse Electric & Manufacturing Co., San Francisco
Frank H. Mills, Electric Appliance Co., San Francisco
Tom Bennett, Rex Electric Co., San Francisco
F. A. Gerhardt, Crouse-Hind Co., San Francisco
W. H. Hemington, City Protective Electric Co., San Francisco
C. B. Kenney, NePage-McKenny Co., San Francisco
John M. Gregory, secretary East Bay Electrical Trades Ass'n, Oakland
E. A. Chloupek, Kimball Electric Co., Oakland
J. T. Stewart, Standard Electric Construction Co., San Francisco
William H. Beamer, J. C. Hobrecht Co., Sacramento
S. B. Gregory, Arrow Electric Co., San Francisco
R. J. Holtermann, Holabird Electric Co., San Francisco
M. Meade, California Machinery and Electrical Engineering Co., Sacramento
W. S. Cass, Chico Electric Supply Co., Chico
Robert L. St. John, State Department of Engineering, Sacramento
G. M. Simonson, State Department of Engineering, Sacramento
James A. Woods, California Machinery and Electrical Engineering Co., Sacramento
F. T. Broiles, International Electric Co., Los Angeles
S. P. Russell, H. B. Squires Co., San Francisco and Los Angeles
H. W. Lewis, Lewis Electric Co., Fresno
F. M. Robinson, Electrical Contractor, Fresno
Clark Baker, National Mazda Works of General Electric Co., Oakland
Elbert Kramer, Westinghouse Electric & Manufacturing Co., San Francisco
Stephen E. Dunn, Westinghouse Electric & Manufacturing Co., San Francisco
H. W. Rosenberg, Pacific Electric Construction Co., San Francisco
Theodore DePass, Atlas Electric Co., San Francisco
H. Surryhne, A-1 Electric Construction Co., San Francisco
H. H. Courtright, Valley Electrical Supply Co., Fresno
M. L. Scobey, Home Electrical Co., San Francisco
R. A. Balzari, Westinghouse Electric & Manufacturing Co,, San Francisco
L. R. Ardouin, secretary San Francisco Association of Electrical Contractors and Dealers.
Louis Levy, Levy Electric Co., San Francisco
E. P. Markee, Edison Lamp Works, General Electric Co., San Francisco
Clyde L. Smith, Central State Electric Co., Fresno
Clifford Prudhomme, W. P. Hyatt Electric Co., Sacramento
W. P. Hyatt, W. P. Hyatt Electric Co., Sacramento
George H. Curtiss, Electric Ry. & Manufacturing Co., San Francisco
George A. Zelt, J. C. Hobrecht Co., Sacramento
C. J. Thelen, Electric Ry. & Manufacturing Co., San Francisco
P. J. Hobrecht, J. C. Hobrecht Co., Sacramento
Frank Killam, Pacific States Electric Co., San Francisco
W. A. Murphy, Bright Spot Electric Co., Stockton
Marcel L. Hirsch, Alexander & Lavenson, San Francisco
E. E. Browne, Browne & Langlais, San Francisco
H. J. Mayo, Benjamin Electric Manufacturing Co., San Francisco
G. W. Spencer, Spencer Electric Co., Oakland
O. E. Smith, Great Western Power Co., Sacramento
F. E. Kaye, Great Western Power Co., San Francisco
T. J. Dillon, Great Western Power Co., Sacramento
W. A. Weigt, Sterling Electrical Co., Sacramento
A. P. Peck, Holabird Electric Co., San Francisco
C. W. Beaton, City Electrician, Sacramento
J. O. Tobey, Pacific Gas & Electric Co., Sacramento
W. E. Camp, General Electric Co., Sacramento
George B. Sanford, Great Western Power Co., Sacramento
Carl Mixer, Mixer Electric Co., Lodi
L. P. Van Atta, Pacific States Electric Co., San Francisco
Chet Osborn, C. E. Osborn Co., Turlock
C. J. Franke, Commercial Electric Co., Stockton
W. T. Flanagan, Electric Equipment Co., Stockton
S. G. Gearhart, General Electric Co., Stockton
William Blide, Blide Electric Co., Santa Cruz
Walter Cox, Cox Electrical Co., Santa Cruz
R. J. Finshly, California Mech. & Elec. Engineering Co., Sacramento
F. H. McGinnis, Sacramento Appliance Co., Sacramento
F. E. Boyd, General Electric Co., San Francisco
D. E. Harris, Pacific States Electric Co., San Francisco
B. E. Cunningham, Vallejo Electric Light & Power Co., Vallejo
Albert Caspar, Vallejo Light & Power Co., Vallejo
Arthur E. Rowe, Garnett Young & Co., San Francisco
H. C. Hopkins, Westinghouse Electric & Manufacturing Co., San Francisco
C. C. Hillis, Electric Appliance Co., San Francisco
Robert King, King's Electric Co., Oakland
R. V. Oyler, Capitol Electric Co., Berkeley
W. D. Thomas, Electric Appliance Co., San Francisco
C. W. Farrow, electrical contractor, San Francisco
Ed. H. Brumfield, Brumfield Electric Sign Co., San Francisco
B. J. Doherty, electrical contractor, San Francisco
J. W. Redpath, secretary California State Association of Electrical Contractors and Dealers.

San Francisco Section, A. S. M. E.

Report from San Francisco Section Delegate to Conference of Section Representatives, A. S. M. E., December, 1919.

BY ROBERT SIBLEY

The San Francisco Section prides itself upon the fact that it has instituted in the Far West the model section of the Society. Detail description of the section organization and activity was set forth in our report to the section conference at the annual meeting of the Society in New York, December, 1918.

During the past year remarkable strides forward have been made.

Under the able chairmanship of W. F. Durand, Professor of Mechanical Engineering, Stanford University, and a past vice-president of the Society, the San Francisco Section has first made a survey of war activities of its membership, and quite recently a survey of research activities has developed the fact that considerable important research activity is now under way that will later prove of national value.

Organization —

Since a complete description of our organization was set forth in the 1918 report as noted above, no effort will here be made to enter into further detail concerning the interesting and efficient method established in San Francisco Section life, as those interested may refer back for full details.

Meetings —

We are this year following the scheme instituted last year of informal luncheons each Thursday at the San Fran-

W. F. Durand, chairman San Francisco Section, A. S. M. E.

J. A. Kinkead, secretary San Francisco Section, A. S. M. E.

cisco Engineers' Club. We have monthly evening meetings for discussing technical papers. Three meetings a year in the evening are devoted to joint gatherings with four other national engineering society local sections.

Papers —

The papers at the monthly meetings are usually of current problems concerning mechanical engineering subjects of peculiar importance in the West, while the joint engineering meetings discuss problems of wide general interest to the engineering profession as a whole.

Membership —

We draw our membership from a community of about one million inhabitants; our mailing list numbers over five hundred members of the Society.

Research —

As noted above, a complete survey of research activities has been instituted and completed during the past year. The results of this survey are now on file with the Research Committee of the Society.

Relations with the Public —

Great activity is being manifested by our membership along lines of bettering relations of the engineering profession with the public. Considerable thought expressed jointly with four other local sections of national engineering societies is being given with respect to the subject of licensing of engineers.

Sections Development in General —

In the Far West emphatic need is felt for the establishment of a Pacific Coast headquarters for the Society. It is believed that the retaining of an active, enthusiastic secretary and permanent headquarters—perhaps supported jointly by the national societies—would not only add vastly in increasing interest in national engineering society movement but, from a financial viewpoint, the resultant inflow of money from vastly increased membership, would more than pay for the outlay.

San Francisco Section extends greetings to her sister sections throughout the nation and the hope is entertained that all visiting members will make themselves known, for a cordial welcome is always in waiting for all who visit this happy section of our society situated in the City by the Golden Gate—San Francisco.

San Francisco Electrical Development League

The meeting of January 12th was taken up with the "send-off" to Russell H. Ballard, president of the N. E. L. A., before his departure for the East. Robert Sibley, editor of the Journal of Electricity, spoke on "The Vision of 1920." The proceedings of this meeting are described at length elsewhere in this issue.

On January 19th, the League members listened to a discussion of "The Elements of Rate-Making," by W. G. Vincent, Jr., valuation engineer of the Pacific Gas & Electric Company. Mr. Vincent gave a very instructive talk dealing with the history of utility rates on the Pacific Coast and showed by means of charts and diagrams the means by which equitable rates are arrived at. His remarks were supplemented by Senator C. P. Cutten, rate attorney for the Pacific Gas & Electric Company, who ably presented the legal aspects of the subject. James B. Black, of the Great Western Power Company, acted as chairman of the day.

An amendment to the Constitution of San Francisco Electrical Development League to lengthen the term of office for its officers to one year, read at a meeting on Monday, January 19, 1920, to be voted upon Monday, February 2, 1920, is as follows:

Article IV, Section 3:

The term for which all officers shall serve shall be one year, from March 1st to March 1st, or until their successors are elected or appointed.

Article V, Section 2:

At the business meeting of the League held in February, officers and members of the Executive Committee shall be elected by ballot. Prior to the meeting of the League held in February the President shall appoint a Nominating Committee of five (5) members, whose duty it shall be to submit a report at the business meeting in February, giving names of one or more members whom they would recommend to be placed in nomination for each of the offices being filled at that election.

PACIFIC COAST CONVENTION A. I. E. E.

The Pacific Coast Convention of the American Institute of Electrical Engineers will be held in the Multnomah Hotel, Portland, Oregon, on July 21st, 22nd and 23rd, 1920. The following chairmen of committees have been appointed:

O. B. Coldwell, programme.
C. P. Osborne, publicity.
W. C. Heston, arrangements.

NEW MEXICO ELECTRICAL ASSOCIATION

The sixth annual convention of the New Mexico Electrical Association will be held at Albuquerque, New Mexico, on Feb. 16th, 17th and 18th, 1920.

Among the papers and addresses will be:

"The Coal Situation"....D. E. Bent, Tucumcan Light & Power Co.
"Fire Loss by Electricity"....L. A. Barley, Rocky Mountain Fire Underwriters' Association, Denver
"My Relation as Legal Advisor to the Association"....Albert Simmis
"Developments in the Electrical Industry"....B. C. J. Wheatlake, Mountain Electric Co., Denver
"Outlook for Electrical Merchandising, Year 1920"....J. J. Cooper, Mountain Electric Co., Denver
"Westinghouse Subject"....K. E. Van Kuran, Westinghouse Electric & Mfg. Co., Los Angeles
"The Public Relations of Public Utilities....J. F. Greenawalt, Mountain States Telephone & Telegraph Co., Denver
"A Scientific Paper"....Prof. R. W. Goddard, New Mexico College of Agriculture and Mechanical Arts
"A Paper on the Lamp Industry"....W. C. Wurfel, Westinghouse Lamp Co., Los Angeles
"A Scientific Paper"....S. E. Doane, Chief Engineer, National Lamp Works, Cleveland, O.

The meeting on Tuesday morning, February 17th, will be opened by R. H. Ballard, president of the National Electric Light Association, with an address entitled "Relation of the N. E. L. A. to the Central Station."

All papers and addresses will be followed by discussion. An executive session, with election of officers, will be held on Wednesday afternoon, February 18th. The annual banquet will be on Tuesday evening.

Electrical Banquet

A dinner meeting of those interested in the electrical industry was given under the auspices of the East Bay Electrical Trades Association in the banquet room of the Pacific Building, on Jan. 27th. Over one hundred electrical men from all branches of the industry were gathered together at this meeting, which represented the power companies, manufacturers, jobbing houses and contractor-dealers.

Hugh Kimball, president of the association, presided. Among other things, he stated that the work of the association was being conducted along educational and ethical lines, and that its primary purpose was to encourage the confidence of the public in the electrical contractor-dealer and the confidence of honest competition among the members. The principal topic of discussion was the work of the California Electrical Cooperative Campaign. A review of this work was made in a most interesting manner by Mr. D. L. Harris of San Francisco, a member of the campaign committee. He showed that the California idea of cooperation all along the line ultimately expressed itself in terms of service to the consumer. He further stated that the idea of a campaign of cooperation had originated in this state and that the record of the activities of the California Electrical Cooperative Campaign had invaded the East, where it was generally conceded California had set the pace in bringing to the home the proper appreciation of things electrical.

Other phases of campaign and association work were reviewed by Captain Howard Angus, secretary of the Campaign, Merrel Hixson, advertising director, R. D. Holabird of Oakland, Arthur E. Rowe of San Francisco, and Clyde B. Chamblin, president of the California State Association of Electrical Contractors and Dealers. The constructive policies presented by these men reflect credit on the electrical industry and the local association should feel gratified at the success of the meeting.

An Inspiration for 1920

BY FREDERICK S. MYRTLE

(The most significant meeting of the year preparatory to that of the great convention of the National Electric Light Association in Pasadena, California, May 18-21, 1920, was held in San Francisco, Jan. 12, 1920. The matter brought out at this meeting proved so helpful in spreading broadcast the vision to be held in mind by men of the Electrical West that a description is here given of this meeting at considerable length. The author is Editor of Pacific Service Magazine and a recognized writer of wide acquaintance on matters electrical. — The Editor.)

That the West has a greater message for the East than the East has for the West, and that the vision of the West has been broader of scope and more fruitful of accomplishment than any vision that can be credited to our sister states on the other side of the Rockies was the prevailing sentiment in an important gathering held at the Palace Hotel, in San Francisco, January 12th, under the auspices of the Electrical Development League.

The occasion was the weekly luncheon of the league, and an unusually large attendance was in honor of R. H. Ballard, of Los Angeles, and John A. Britton, of San Francisco, who were about to undertake a trip east to spread the propaganda of the West among the leaders of the electrical industry on the Atlantic seaboard. Mr. Ballard enjoys the distinction of being the first Californian elected to the presidency of the National Electric Light Association, while John A. Britton serves the association in the capacity of chairman of the public policy committee. Their trip east has for its main purpose the conclusion of preparations for the annual national convention of the association, which takes place in Pasadena May 18th-22nd. Some idea of the importance of the convention may be gathered from the announcement that it will number upwards of three thousand delegates, including all the leading lights of the electrical industry in the country, besides representatives of the big financial houses that deal largely with public utility securities. A conservative estimate of the invested capital represented at this convention would be in the neighborhood of three billions of dollars.

The idea of a message from the West to the East, then, was a happy one for this gathering, and it was featured in unusual style through an address by Robert Sibley, editor of the Journal of Electricity, who presented facts and figures to show that in nearly every line of endeavor the Pacific Slope has done more in actual accomplishment, particularly in pioneering, than any other section of this great country. Mr. Sibley showed, for instance, that whereas the West represents but eight per cent of the total population of the United States, yet in water power development it is a long way in the lead. It leads, also, in the consumption of kilowatt-hours per capita, and this in the enormous proportion of three to one; while in the way of potential development it commands no less than 36,000,000 horsepower out of a total in the United States of 51,000,000.

In accomplishment today western enterprise presents some records worthy of considerable consideration. One instance is furnished by the combination of electric service facilities afforded by the systems of the Pacific Gas and Electric Company, Great Western Power Company and the Sierra and San Francisco Power Company. This pool, as it were, of the electric product was ordered by the power administrator in the service of the California State Railroad Commission early last year, and the record showed an aggregate of a billion and a half kilowatt-hours for last year. This, according to charts produced by Mr. Sibley, showed the western combine leading all others in the country, exceeding in output even the Edison Commonwealth of Chicago, long recognized as the greatest power generating public service concern.

Another point dwelt on by Mr. Sibley was the interconnection of electric transmission lines which, so far, has joined the power sources lying in the Cascade Mountains of Oregon with the Bay of San Francisco, and with the shortly to be completed line connecting the Pacific Gas and Electric Company's service in the San Joaquin Valley with the northern portion of the San Joaquin Light and Power Company's system will eventually form an unbroken chain of electric transmission reaching from the Oregon mountains to the Mexican border.

Many installations worthy of notice the lecturer showed. Prominent among these were the 18,000 horsepower turbine in the Wise power house near Auburn, the property of the Pacific Gas and Electric Company, known to the electrical world as the largest single discharge turbine in existence, and the South Tower, on the heights above Port Costa, where the Pacific Gas and Electric Company's lines across Carquinez Straits by overhead cable. This is known as the second largest cable span in the world. The Great Western Power Company's power cable under San Francisco Bay, three and one-half miles in length, was brought forward as the longest of its kind in the world; the Big Creek plant of the Southern California Edison Company was exhibited as the transmitting end of the longest up-to-date single transmission system in the world, whereby electricity is sent into the city of Los Angeles, a distance of 250 miles, under a propelling force of 150,000 volts.

Editor Sibley showed various reclamation and irrigation pictures. He showed some notable achievements in the way of dams, notably, the Elephant Butte dam in New Mexico and the Roosevelt dam in Arizona. The Calaveras dam of the Spring Valley Water Company, now under process of construction, was instanced as the largest earth-filled dam, when completed, in the world. The highest rock-filled dam in the world is in San Diego County, and the highest dam of any kind also belongs to a Pacific Coast State, namely, the Arrow Rock dam in Idaho, 347 feet above the stream bed. Pictures of gold-dredging, an industry more successfully prosecuted in California than elsewhere, were shown; views of the Hetch-Hetchy Valley water and electrical development projects; the electrically equipped camps in the Yosemite Valley; the electrified roads of the Chicago, Milwaukee and St. Paul system in the Northwest; the University of California with its 9,600 students; three or four of the greatest men in the eye of the public just now, with Hoover at their head.

All these were featured by Editor Sibley in his address upon what he called "The Great Vision of the West." He closed a most interesting talk with a recommendation upon the point of "self interest," showing how it was the duty of the present-day developer to show to the people generally how their interest, as well as, if not more than, his own, are involved in the success of his enterprise. He quoted, in conclusion, the words of St. Paul: "Let us watch and be thoughtful."

John A. Britton introduced Robert Sibley in happy fashion. John B. Miller, chairman of the board of directors of the Southern California Edison Company, in responding to the call for an address, spoke upon public sentiment, and urged upon his hearers the necessity for understanding that the success of a public service enterprise must go hand in

hand with favorable public opinion and that every energy should be bent in securing that favorable opinion in a thorough, honest, businesslike and straightforward way.

Mr. Ballard closed the speaking with a few words under the heading "Everybody Works." It was the business of the electrical men of the West, he urged, to make the production equal to the demand, and until the day came when that aim should have been accomplished it was useless, he thought, to expect a reduction in the muchly complained of high cost of living. As for the great convention to be held in Pasadena in May, it would be necessary for all present, nay, for every member of the electrical industry in California, to constitute himself an integral part of the campaign of promotion, in order that as in vision and accomplishment the West already leads the world, so it might hand down to history the greatest and most notable gathering of electrical men ever held anywhere on the earth's surface.

The meeting closed with a hearty "au revoir" to Ballard and Britton. Ballard left the following morning for New York. Britton expects to follow him in a few days.

HAPPENINGS IN THE INDUSTRY

COMMISSION HEARING

At a hearing held before the California State Railroad Commission at Fresno, California, on Jan. 5th, 1920, before Commissioner Delvin in the matter of wage increases of the San Joaquin Light and Power Company, Senator L. H. Roseberry, in charge of the trust department of the Security Trust and Savings Bank of Los Angeles, stated that during the past year savings banks mortgages on real estate had been either greatly amortized or paid off and that now savings banks were in the field for new investments. The public utilities security is one of natural attraction to bankers, but due to the history of public utilities to some extent it has been not in high favor with savings banks that seek a very stabilized security as well as a good fair rate of interest, that being due probably to the history of some public utility that led them to be so regarded rather than their present condition.

The present situation is that regulation by public service commissions has solved the problem as far as the investor is concerned. The commission stands between the consumer and the producer, as he termed it, and insures enough security and fairness to both sides to stabilize the business itself. Those who own securities of the hydroelectric power companies want to know that the industry is going to be put on a permanent basis, both as to the maintenance of its present equipment as well as the encouragement of its equipment to meet advance demands of the community in which it is operating and to develop that community so as to create a fixed demand for its commodities and continuing fixed demand.

If capital can secure the same security and a greater rate of interest from other enterprises it will naturally not flow to public utilities. So in order to develop a public utility there has to be a reasonable attraction to it, at least from the investor's standpoint. Unless the public utility is encouraged and can draw sufficient capital to stabilize its business and provide for extensions and improvements, the consumers cannot expect to get a permanency of service nor extension of it.

California banks are loaning very heavily in the agricultural communities for the development of farm lands and this land depends largely upon the furnishing of hydroelectric power for irrigation purposes. And if there is an assurance that the supply of hydroelectric energy will be sufficient to meet the demand the banks will naturally go behind the loans on the land quicker than they would without that assurance. They will also purchase the securities of the public utilities themselves more readily if that factor is satisfied, and they will advise their clients to do likewise.

The most important single factor is therefore the sustained continuous earning of a public utility sufficient to enable it to meet all of its financial requirements for development and to provide for development of the plant.

Cyrus Pierce, president of Cyrus Pierce & Company, dealers in bonds, and investment bankers, stated as follows:

"Due to the fact that street railway systems of the country have sustained severe financial setbacks, the securities of public utilities in general have not met with a popular appeal, as the public considers a street railway and other public utilities in the same category. However, the discriminating investor and the banker easily and understandingly differentiate between the troubles that exist with reference to street car utilities and utilities of another character. But the rank and file of investors do not stop so to discriminate.

"It is the duty of the bond houses to make a careful analysis and see whether the security is behind the various financing schemes proposed and then to buy securities with their own money and afterwards distribute it to the small investor, giving to him the more responsibility of the bond house in addition to the security of the public utility.

Mr. Pierce's institution thought that not less than $250,000,000 would be necessary to meet the demands of the hydroelectric companies in California during the next ten years and they considered that those figures are very conservative. It was his opinion that it was to the greater interest of the people of the State of California to see that power was properly developed, rather than to quibble over a difference of one-tenth or two-tenths cents in the price of the commodity at the present time. Mr. Pierce continued:

"At least 33 per cent of the money necessary must be obtained by the sale of junior securities such as preferred stock and securities of that kind where there is an ownership interest rather than a creditor's interest.

"The tremendous San Joaquin Valley of California is now only about 20 per cent developed and the other 80 per cent is absolutely dependent on hydroelectric power and nothing else. And if the companies do not get the necessary money for development the vast San Joaquin Valley will remain untouched.

"There is one thing which must be realized and that is that there is nothing sacred about money. It is a commodity which will flow where the highest price is obtainable.

"I think the dictum of the California State Railroad Commission given at the beginning of the war to the effect that the corporations of California shall be kept solvent has done more to attract the attention of the investors to California securities than any other one act of which I know.

Regulation necessarily implies preservation but some commissions regulate and do not preserve. Commissioner Devlin stated that the California State Railroad Commission was now equipped properly to supervise with reasonable accuracy the expenditures of the public utilities of the state and see if the expenditures made had the equivalent return in the property, and the commission keep in sufficient touch with these utilities to see that the work rendered by the utilities or for the utilities approximate in efficiency that of any other similar line of business.

NATIONAL ELECTRIC LIGHT ASSOCIATION EDUCATIONAL COURSES

The Educational Courses which were arranged by the Commercial Section of the National Electric Light Association, and which cover Practical Electricity, Commercial Engineering, Elementary Accounting and Advanced Accounting, were offered to the employes of the Southern California Edison Company during the early part of the present winter. At the present time there are approximately three hundred of the employes enrolled as follows: 280 in Practical Electricity, 8 in Commercial Engineering, 10 in Elementary Accounting, and 2 in Advanced Accounting.

These courses, while designed as correspondence courses, and which can be successfully carried on as such, with a

great deal of benefit to the student, are being supplemented by classes by this company. Already classes have been held in several of the districts with an attendance of from twenty-five to seventy-five, depending upon the size of the district.

At these meetings, demonstrations of the principles and theories covered by the instruction book are performed, and where necessary such theories are elaborated upon. Following this a general discussion is held, which offers the students an opportunity to ask questions regarding principles that have not been made sufficiently clear by the instructions given. It is believed that the effectiveness of the course is greatly increased by such meetings and discussion.

The courses as arranged consist of from ten to fifteen lessons, and it is proposed to hold a meeting in each district for the discussion of each lesson.

In the promotion of this work, it was found advantageous and effective to invite all of the employes in a district to the first meeting, in order that they might gain a better idea of the purpose and worth of the course. The enrollment in one of the districts was more than doubled following the initial meeting.

The courses are in charge of F. B. Lewis, superintendent of the Los Angeles district, Southern California Edison Company.

FIXING A WAGE SCALE IN FRESNO

The members of the joint board, consisting of five representatives appointed by the Building Trades Council of Fresno, and five representatives of the Building Industries Association of Fresno, which met on December 19, 1919, submitted a report to their respective organizations, from which the following is extracted:

1. The wage scale will be:

Bricklayers	$10.00	Carpenters	8.50
Plasterers	10.00	Painters	8.50
Cement Finishers	9.60	Glaziers	8.00
Plumbers	9.25	Millmen, Sash and Doors	7.00
Steamfitters	9.25	Millmen, Benchmen	7.50
Electricians	9.25	Millmen, Foremen	8.50
Iron Workers	9.00	Hod Carriers, Plaster	8.00
Sheet Metal Workers	9.00	Hod Carriers, Brick	7.00
Lathers	9.00	Cement Workers	7.00
Roofers	8.00	Teamsters	6.00
Engineers	8.00	Common Laborers	5.50

The above scale will become effective January 1st, 1920, with the exception, that in the case of such unions as have been granted this scale by the Building Trades Council, subject to the usual ninety days notice, the scale will become effective at the expiration of the ninety days.

2. No future increase (after January 1st, 1920) will be asked by any union nor granted by the Building Trades Council, excepting in the event that an increase of ten per cent occurs in the cost of living from and after October 13th, 1919, whereupon an increase of fifty cents per day for each craft will automatically be granted, and successive increases of fifty cents per day for each and every subsequent increase of ten per cent in the cost of living, will continue to be granted thereafter.

The statistics prepared and reports issued by the U. S. Secretary of Labor will be the only evidence presented or considered as proof of increase of living cost. These reports will be presented to and considered by this joint wage adjustment board, and their action will be final in declaring an increase. Any increase so declared will become effective on the second Monday following the declaration of the same by the Board.

3. In the event of any raise after January 1st, 1920, all contractors or sub-contractors who have legitimate contracts on hand, and who have filed memo of such contracts with this Board prior to the declaration of increase in scale, will be reimbursed by each local union furnishing men for the work affected, in the full amount of the actual additional labor cost resulting from the said increase. No contractor or sub-contractor will be protected on contract work who has not filed memorandum of contract with this Board prior to declaration of increase. The decision of this Board will be final as to the legitimacy of contracts filed, and it will have the power to require and consider evidence in any instance in question.

This Board will not grant reimbursement to any contractor or sub-contractor who is not a member or associate member of the Building Industries Association.

This report, if ratified by all local unions and by the association, will constitute a working agreement covering the method of increasing wages during the year 1920, and the method of protecting contractors during said period, and the agreement will be considered executed when the Board has received formal written notice from each organization, through its secretary, that the said organization has ratified this report.

LICENSING OF ENGINEERS

The fifteen members of the committee on licensing engineers as appointed by the Engineering Council, were selected from thirteen states, viz: Connecticut, New York, Pennsylvania, Ohio, Georgia, Louisiana, Illinois, Missouri, Iowa, Minnesota, Colorado, California and Washington, and therefore represent practically all sections of the United States, as well as mechanical, electrical, mining, hydraulic, municipal, sanitary, railway and structural engineering, and also college of engineering.

The report of the committee runs in part as follows:

The first work of the committee was to investigate the general subject and to collect, so far as possible, available material bearing upon the subject in hand, including opinions from many engineers as to the need or desirability of legislation, as well as copies of all state laws passed and proposed, having to do with licensing or registration of engineers, architects and surveyors.

This preliminary investigation disclosed that very pronounced views were held by engineers throughout the country, both for and against state licensing or registration. The general sentiment one year ago was more opposed to such measures than it is today. The older members of the profession did not as a rule favor licensing nor did they feel there was need for state regulation of engineering practice, while among the younger men there was a feeling that licensing or registration by the states would add prestige to professional engineers and in many ways benefit the profession, as well as individual engineers.

The advantages claimed for state licensing or registration are the same as those presumably gained by the laws regulating the professions of law and medicine, namely, that those who are incompetent and unqualified professionally to practice are unable to obtain certificates or licenses and hence both the public and the profession are protected. On the other hand, those engineers who have already attained to recognized professional standing feel, they not only do not need the benefits claimed for such legislation, but they fear that state licenses or certificates of registration are apt to put the seal of state endorsement on men who do not deserve it and that the public would assume that a licensed or registered engineer was thereby certified by the state as fully qualified, regardless of what might or might not be the requirements demanded before a license or certificate was granted.

However, the question has gone beyond the stage of debate, for already ten states* have enacted laws licensing or registering engineers, and other states are certain to enact similar laws during the present or coming sessions of their legislatures. In addition to these ten laws governing engineering practice, there are at least six states that require the licensing or registration of land surveyors and in at least eighteen states** laws have been passed licensing or registering architects. Some of these ten laws are so drawn as to include both engineers and surveyors and some include engineers and architects and one or two include engineers, architects and surveyors. Moreover, these laws are not at all uniform and in several instances are likely to prove seriously embarrassing and annoying to engineers whose activities extend beyond the limits of a single state. Because of the nature of professional engineering work the practice of an engineer frequently extends over several states and therefore it is vitally important, if there are to be state regulations for engineering practice that these regulations be made uniform so far as possible and that the engineering profession unites in wisely directing such legislation.

This committee has made a very careful study of definitions for "engineer," "engineering," "architect" and "architecture," but it was found that any definitions for engineering would be so general as to include too much, or too specific to be sufficiently general, or too voluminous to be suitable to incorporate in a law. Some have endeavored to include in a definition of "engineering practice" all sorts and kinds of construction work, but engineering includes investigations as well as plans and no catalogue can well be prepared sufficiently detailed to include all sorts of engineering activities.

The only basis on which the practice of any profession may be subject legally to state regulation is "in order to safeguard life, health and property." The state may not dictate that no one without a particular kind of artistic talent nor without a tenor voice may practice engineering or architecture, but it may legally require that no one shall practice architecture or engineering that is ignorant of the effects of loads and applied forces or incapable of determining the stresses in structures due to loads and applied forces and unable properly to proportion materials in structures to safely sustain such loads and forces.

This committee has deemed it advisable and to the best interests of all concerned to include in one law, provisions for the registration of engineers, architects and land surveyors. It has recognized that the practices of engineering and architecture overlap in many instances, especially in connection with the larger projects of modern structures, where many branches of the arts and sciences are combined, involving architecture, structural, mechanical, electrical, sanitary, and other lines of engineering.

In fixing the qualifications for registration in our proposed bill, these have been purposely made high, but they have not been made unnecessarily difficult for reasonably competent men to meet. It is not intended that candidates would ordinarily be subjected to written examinations, but rather that the board of registration would pass upon the sufficiency of the professional record of each candidate. Minimum qualifications have been clearly set forth which must be met. In order to enable the board to pass upon candidates fairly, certain qualifications are specified as "prima facie evidence of fitness" which (unless other facts derogatory to a candidate are also in evidence) will permit the board to pass the candidate. This so-called "prima facie evidence" is not required, but if the candidate can present such evidence his application is the more readily passed upon. For instance, a candidate need not be a graduate of a college of engineering or architecture, but if he is, it is to his advantage. Likewise a candidate need not be a full member of one of the national technical societies or institutes, but if he has won such full membership it is greatly to his professional advantage.

The committee unanimously approved the bill as sent out with minor suggestions for guidance in the final editing. This editing is now completed and the bill is submitted to Council, with report and recommendation that Council approve and endorse the same as a bill for an act of legislation in each and every state, for the regulation of the practice of engineering, architecture and land surveying.

*Colorado, Florida, Idaho, Illinois, Iowa, Louisiana, Michigan, Nevada, Oregon, and Wyoming.

**California, Colorado, Florida, Idaho, Illinois, Louisiana, Michigan, Montana, New Jersey, New York, North Carolina, North Dakota, Oregon, Pennsylvania, South Carolina, Utah, Washington, and Wisconsin.

THE STANDARDIZED ACCOUNTING SYSTEM

In beginning a new set of books, as many contractors and dealers now are doing, the opportunity should not be overlooked of adopting the standard accounting system worked out by the National Association of Electrical Contractors and Dealers. Subscriptions for this system may at any time be entered with the secretary of your State Association, to whom checks should be made out for transmittal to the National Association. It should be noted that a special price of twenty-five dollars, express collect, is accorded to association members, the cost to others being forty dollars.

The Journal of Electricity has in preparation a series of fifteen articles to deal with elementary principles of bookkeeping as related to the accounting system here recommended. The series is being arranged in cooperation with the Extension Division of the University of California, the articles appearing in the Journal to serve as one of the texts for the course of study involved. This is one of the most far-reaching enterprises in which the Journal of Electricity has ever been engaged, and further announcement will be made thereon in later issues.

APPROVAL OF PUBLIC UTILITY LEASE

"The lease is distinctly in the interest of the public," declares the Railroad Commission in an order issued recently approving the lease by the Sierra & San Francisco Power Company of its properties to the Pacific Gas & Electric Company. The lease is to run for a period of fifteen years, dating from January 1, 1920. In addition to paying all taxes and governmental charges, providing for special funds created by the lease and setting aside 2 per cent of the gross revenues received from the leased properties for depreciation the gas company is to pay a rental of $50,000 a year for two years, $100,000 for the third and $150,000 for each of the remaining years of the lease.

Commissioner Irving Martin, who wrote the opinion accompanying the order of approval, calls attention to service improvements that will follow as a result of the lease. He says:

"Considerable preliminary work has been done towards the installation of the so-called "Spring Gap plant" on the Stanislaus River. Material has been ordered for a second transmission circuit from Port Marion to Salinas in order to improve the service conditions in Salinas and other territory served by the Coast Valleys Gas & Electric Company which buys its energy from the Sierra company. Material has also been ordered to strengthen the line from Manteca to Modesto, thence interconnecting from Modesto to Newman, with provisions for an additional line to Turlock. Work has already been started by the Sierra company on an additional pipe line to its Stanislaus plant. The estimated cost of these projects is in excess of $1,000,000."

The Sierra & San Francisco Power Company sells and distributes water in Tuolumne County and electric energy in the "Mother Lode District" of Tuolumne and Calaveras counties; in Stanislaus, San Joaquin, Contra Costa, Alameda, Santa Clara, San Benito and Monterey counties and the city of San Francisco. It supplies power to the United Railroads of San Francisco, 62 per cent of its earnings from the sale of electricity coming from the street railroad company.

SUPREME COURT UPHOLDS DECISION OF CALIFORNIA RAILROAD COMMISSION

Upholding the jurisdiction of the California Railroad Commission over wholesale public utility rates the United States Supreme Court on January 19th, established a precedent for all utility commissions throughout the country. The case on which the decision was handed down, that of the Napa Valley Electric Company, was regarded as a test case by all utility commissions.

The California Light & Telephone Company applied to the Railroad Commission to have the commission fix the rate for the wholesale service energy supplied to it by the Napa Valley company. The California company retails the service to consumers in and about Calistoga. The Napa Valley company opposed the application, claiming that the commission had no jurisdiction over the rate for this wholesale service, which was supplied under a contract between the two companies. The Railroad Commission held that it had jurisdiction over wholesale utility rates and this decision of the commission was taken to the courts by the Napa Valley company.

The decision of the United States Supreme Court upholds the decision previously rendered in California by Judge Van Fleet, sustaining the jurisdiction of the Railroad Commission.

The case was argued before the United States Supreme Court December 9 by Attorney Douglas Brookman for the commission.

MAJESTIC ELECTRIC DEVELOPMENT COMPANY

The board of directors of the Majestic Electric Development Company met in San Francisco on January 13th and elected officers for the coming year. Those chosen were: E. N. Brown, president; M. H. Shoenberg, vice-president; T. D. MacMullen, secretary and sales manager. An increase of business of 300% over the preceding year was announced for 1919. No change of policy has been planned for 1920.

TRADE NOTES

New Installations —

The Detroit Electric Steel Furnace Company is furnishing the Oregon Brass Works of Portland, Oregon, two electric furnaces. The West Coast Electric Company is making the electric installation. Cost approximately $20,000.

A. E. Meserve is installing the electric work in the new Herbert Gordon building, 285 Stark Street, Portland.

Jaggar-Sroufe Company are installing the electric work in the Mitchell, Lewis & Staver building, Portland, Oregon.

New Electrical Store —

A new electric shop, under the name of Wolff Electric Works, has opened up at 65 North Ninth Street, Portland, Oregon, specializing in rewinding and repair work.

Changes in Equipment —

Vanderlipp & Lord are making extensive changes in the electric equipment of the Liberty Theater, Portland, Oregon.

Manufacturing Equipment —

The Big-Four Electric Company, of Tacoma, Wash., is now equipped to manufacture domestic tank heaters, electric steam generators, hot water circulating boilers, air heaters, and pipeless electric furnaces. They have delivered 100 heaters to the City of Tacoma.

New Agencies —

The Coast Equipment Company, with offices in the Merchants Exchange Bldg., San Francisco, and San Fernando Bldg., Los Angeles, has been appointed exclusive sales agent for California and Nevada for the following companies: Ridgway Dynamo & Engine Co., Ridgway, Pa., manufacturing turbo-generator sets, alternating and direct-current generators, motor-generator sets, steam-engines, synchronous motors. Pittsburgh Transformer Co., Pittburgh, Pa., transformers. The Atlas Car & Manufacturing Co., Cleveland, Ohio, electric storage-battery and trolley locomotives, storage battery flat-cars and industrial cars. Norwalk Iron Works Co., South Norwalk, Conn., air, oxygen, hydrogen and carbonic-acid gas compressors, and automatic ammonia compressors. Duncan Electric Manufacturing Co., Lafayette, Indiana, watt-hour meters.

Sales Force Increased —

The Central States Electric Company, Fresno, under the management of Klein L. Smith, now has five outside salesmen—four on washing machines and one on general appliances.

Dealers' Meeting —

A meeting of Blue Bird electric washing machine dealers of the San Joaquin Valley, held at Fresno on January 19, was addressed by G. W. McNichols, who has recently come from St. Louis to take charge of one of the Blue Bird stores in San Francisco.

New Firm —

Curry & Will, Inc., is the name of a new firm going into the electrical business in Forest Grove, Ore.

Expansion of Industrial Electric Heating Department —

The Cutler Hammer Mfg. Co. is now devoting new floor space to the Industrial Electric Heating Dept. This is in addition to the space formerly used for manufacturing household electric appliances such as irons, toasters, table stoves, etc., which have been discontinued. The industrial heating line which now is being expanded, includes such well known products as the electric space heater, soldering iron, linotype pot heaters, metal melting pot, chocolate warmers for candy factories, immersion water heater, circulation water heater, tailors' irons and heater units for application to all types of machinery.

Foreign Contract —

Stone & Webster, construction engineers, have recently been advised by cable of their selection by the Kiso Electrical & Industrial Company, Ltd., to supervise the design and construction of a 30,000 hp. hydroelectric development near Nagoya, Japan.

New Office —

The Coast Equipment Company, industrial engineers of San Francisco, have opened an office in the San Fernando Building, Los Angeles, in charge of Ralph B. Clapp. Mr. Clapp is president of the Electrical Cooperative League of Southern California.

Underwriters' Approval —

The Economy Fuse & Manufacturing Company, of Chicago, announce the approval by the Underwriters' Laboratories of Economy Renewable Fuses in all capacities.

PERPETUAL MOTION DELUSIONS

A letter to the Editor

In a paper before the International Electrical Congress I stated in effect "that with the use of water power which nature replenished, and the distribution of this power by means of the electrical system, the curve of human efficiency would tend to become asymtotic to the line representing 100 per cent." Which means that I believe the human being has set before him certain definite limitations which can never be overcome.

The Editor of the Journal of Electricity in an editorial said, that it took a bold man indeed to set a limit to human progress, and stated in effect that progress may go on indefinitely. (I leave it to others as to whether I was bolder for setting a limit than the editor who said there is no limit.)

The remarkable progress in science and its application in the last fifty years has been truly remarkable and almost staggering, especially staggering to the ordinary human with little knowledge of fundamental natural laws. Men often say to me "anything is possible," and I answer decidedly not, and for example I say, "try to give birth to a child."

Nature's laws are fixed and unchangeable. The law of the conservation of energy is as certain on this earth, as the daily cyclic "rise and fall of the sun." If this simple law, which says in effect that the sun of energy of the universe cannot be increased, were generally known there would be little opportunity for the fake perpetual motion schemes that in one way or another crop up periodically. And the surprising thing about these schemes for "lifting oneself by one's bootstraps" is the number of ordinarily intelligent people who believe in them. I have had occasion to come in contact with a number of these fake schemes and schemers.

In one case a certain man collected many thousands of dollars over a period of about ten years from lawyers, doctors and business men, to perfect a scheme by which one horsepower could be multiplied by two. In trying to show the "faker" how absurd his scheme was, I said to him, "If you can multiply one horsepower by two, you can then multiply the two into four, and then the four into eight and go on increasing the amount indefinitely." He said, "Exactly." Then I said: "You can then really start with an infinitesimal amount of power and keep on multiplying it so as to run the universe, starting with nothing whatever." He said: "Exactly." I told him then to get out of the office as fast as he could.

He reported to his "clients" or "suckers" that I was consulting engineer for the power company and I, of course, did not want their business to be thrown in the discard.

The surprising thing is that the lawyers, doctors, and business men believed that to be the case, and so far as I know this man is still collecting money from them.

But can we blame lawyers, doctors, etc., who should of course know better, when even engineers believe in such schemes? A practising consulting civil engineer came to me a few years ago and wanted me to join him to help finance an inventor whose scheme was not only to burn nitrogen in a furnace but continually to reburn the same nitrogen over and over, using no gas or oxygen.

Now an engineer who does not believe in the law of the conservation of energy is about as reliable as a ship captain who insisted on sailing his ship on the theory that the earth is flat.

Civil and mining engineers are occasionally deluded with such schemes because they have not a thorough understanding of the fundamentals of power. Electrical and mechanical engineers are seldom deluded, because they are generally well grounded in the fundamentals of power.

Wireless transmission of electric waves was known before the modern system of electric power and transmission of power were known, and the latter is an improvement of the transmission of electric waves through the air and not vice versa, as is generally supposed. Yet many people believe that wireless transmission of power will some day supersede the modern power and transmission systems. It is of course possible to transmit power through the air but the results **must** be at an **infinitesimal efficiency**, compared to power transmission over ordinary power wires. We can also transmit merchandise packages through the air by means of tubes, etc., but the resulting efficiency **must** be extremely small compared to modern railroad transportation. Power out of the air by the windmill is possible but inefficient and intermittent.

The idea that a great many people have that the aeroplane may some day replace the railroads for economical movement of tonnage is absurd of course. Yet some people in fear sell their railroad stock.

A banker who believed that money could be manufactured and thus double and treble the **wealth** of the world by simply operating a printing press would be a fit subject for the insane asylum or the penitentiary, if not already there. But such a man is the sanest of the sane compared to the men who believe in perpetual motion schemes, or who do not believe in the law of conservation of energy.

Power must always be generated, transmitted and utilized on this earth at less than 100 per cent efficiency; of that we are more certain than death. We can only strive to reduce the losses and get as near 100 per cent as economically possible.

NEW ELECTRICAL DEVELOPMENT

(A great number of applications for water for developing power are indicative of activities in the Northwest. The Pacific Central district has under way important electrical undertakings connected with terminals and city lighting systems. In the Pacific Southwest and the Intermountain district railroad electrification and extensive hydroelectric power developments are conspicuous.—The Editor.)

THE PACIFIC NORTHWEST

SEATTLE, WASH.—Five-cent fares are to remain on Seattle's municipal street car system, the city council has ruled.

SPOKANE, WASH.—The Electric Element Corporation has been incorporated at this place for $200,000 by L. C. Jesseph, C. I. Hodges and W. W. Zant.

YAKIMA, WASH.—The Electric Power & Appliance Company has been incorporated for $25,000 by Albert Schroeder, C. H. Kirby and Arthur L. Fullbright.

SEATTLE, WASH.—The General Electric Company was awarded the contract on a bid of $6,655.12 for furnishing the city with oil switches for the use of the lighting department.

SEATTLE, WASH.—Saxe & Hussey, 315 Pine street, Seattle, are installing an electrical kitchen in the Scottish Rite temple at Broadway and Harvard avenue, consisting of range, steam table, dish washer and coffee urn.

SEATTLE, WASH.—The Allis-Chalmers Manufacturing Company has been awarded a contract by the Board of Public Works of Seattle for furnishing four transformers for the lighting department at $30,000.

SEATTLE, WASH.—Saxe & Hussey, 315 Pine street, Seattle, report considerable activity in the export department of their business. Among the recent orders placed was one for a consignment of vacuum cleaners to be shipped to Shanghai, China.

TACOMA, WASH.—Allis-Chalmers Manufacturing Company, Seattle, recently sold to the St. Paul & Tacoma Lumber Company, Tacoma, five electric motors which will be used for operating the woodworking machinery in its new mill.

SEATTLE, WASH.—The city engineer has presented plans for tunneling Renton Hill from Leschi Park to 22nd avenue and Jackson street and Third avenue from Stewart street to Jackson street, for subways which would cost the city $7,436,350.

SCIO, ORE.—The city of Scio, Linn county, Oregon, has been issued a permit to take 47 second feet of water from the Thomas Creek, a tributary of the Santiam river, for light, power and pumping purposes. Cost of dam, headgate and flume, $38,427.

SEATTLE, WASH.—The Board of Public Works approved the recommendation of Superintendent of Lighting J. D. Ross for furnishing a 50-ton overhead traveling crane for use at the Cedar Falls power house extension of the city lighting plant, estimated cost $6,000.

CENTRALIA, WASH.—President P. W. Kane of the Kane Pneumatic Shock Absorber Company is formulating a plan for the installation of a 500-kw. power plant on Fords prairie, west of here, to furnish current to the Kane factory, being erected on the prairie, and other industries.

TACOMA, WASH.—Sealed proposals will be received at the office of Commissioner of Light and Water, Room 403, City Hall, between noon and 2 p.m. February 3, 1920, for furnishing necessary machinery, equipment and materials for a lighting feeder switchboard at the Nisqually power plant, 25th street substation. A bond for 25 per cent of the bid is required, payment to be made in warrants.

WASCO, ORE.—Homer S. Wall of this place has filed an application with the state engineer for the appropriation of 500 second feet of water from John Day river for the development of 600 horsepower near Early, Oregon. He will construct a concrete head gate and canal 20 feet wide and install a turbine water wheel. The dam has been completed. The construction on the remainder of the work is to be started by April 1, 1920; approximate cost, $57,150.

SEATTLE, WASH.—NePage, McKenny Company, electrical engineers, contractors and manufacturers, Armour Building, Seattle, have been awarded a contract for the complete electrical equipment in Pantages theater at Memphis, Tennessee, including border lights, stage lighting, footlights, strip lights and other necessary lighting facilities incident to modern theater illumination. The company has started electrical work in St. Joseph's hospital at Aberdeen, Washington. The job is to be complete, including light, power and nurse call system.

SEATTLE, WASH.—In his report to the mayor, transmitted by that official to the city council, Superintendent of Lighting J. D. Ross asks for $1,750,000 for completion of Cedar Falls power plant to a capacity of 18,000 kilowatts. He estimates the cost of Cedar Falls plant at $3,500,946.66. The sealing of the new dam has cost to date $381,814.07. The completion of the penstock and the installation of a new generator will add $600,000 to the cost of the plant.

SEATTLE, WASH.—The city is to build 28 miles of railway from Rockport to and up the Skagit river to Gorge Creek for the purpose of delivering the materials needed in the construction of the Skagit river hydroelectric power project. The Board of Public Works has authorized the purchase of 2,665 tons of 65-lb. rails from the Great Northern Railway at $45 per ton, f.o.b. Rockport. This sum of $120,000 is to cover the rails alone. The city is to get out the ties and necessary timber, the railroad bed to be graded through to the dam.

SALEM, ORE.—Six applications, each for 3,700 second feet of water from the Deschutes river, for developing power, have been filed by Frank F. Lischke of Milwaukie, Oregon, in the office of the state engineer. The appropriation asked for is to be used for developing power at different places: Application No. 7005, for diversion at Metolius power site in Jefferson county; No. 7009, for White Horse Rapids power site in Wasco and Sherman counties; No. 7007, for Coleman power site in Jefferson county; No. 7008, for Mecca power site in Jefferson county; No. 7008, for White Horse Rapids power site in Wasco and Sherman counties, and No. 7010 for Pelton power site in Jefferson county.

PORTLAND, ORE.—Sealed proposals will be received by the Oregon State Highway Commission up to February 5, 1920, at 10 a.m., at Room 520, Multnomah county court house, for construction of a double-leaf trunnion bascule bridge with approaches and appurtenant works on the Columbia river highway across Young's Bay in Clatsop county, near Astoria. Requirements are for 75,000 pounds of reinforcing steel, 470,000 pounds of structural steel, 65,000 pounds of machinery, with miscellaneous electrical and other equipment. Bids must be accompanied by a cash bidder's bond or certified check for an amount equal to at least five per cent of the total amount bid. Plans can be obtained from the State Highway Commission or State Highway Engineer, Salem, upon the deposit of $10.

SPOKANE, WASH.—Reorganization of the bankrupt Spokane and Inland Empire railway system was made known with the filing at Spokane of articles of incorporation for the Spokane & Eastern Railway & Power Company and the Inland Empire Railroad Company, the former being capitalized for $3,000,000 and the latter for $1,000,000. The Inland Empire Railroad Company will operate the present "Inland division" of the company, comprising interurban lines to Moscow, Idaho and Colfax, Washington. The other company will operate other property of the concern, including the city street car system in Spokane, the Coeur d'Alene, Idaho, interurban line and the power plant. The property was recently purchased by the bondholders at receiver's sale. F. E. Conners, receiver, and Waldo G. Paine, traffic manager, are named as incorporators.

SEATTLE, WASH.—Expenditures totaling $1,737,234 would be required to carry out a program for the betterment and extension of the municipal street railway system during the year 1920, is what Superintendent Thomas F. Murphine proposed to the city in a recent report to the Seattle city council. The plans include extensions and betterments of track, including reconstruction of the car lines on First avenue South, the purchase of new cars, remodeling of existing cars and the construction of a car barn in the vicinity of West Spokane street. For the track improvements and extensions Mr. Murphine proposes to expend $663,234, exclusive of the First avenue South project, which he estimates will cost $365,000. For new street cars he asks $500,000 and $150,000 for remodeling old cars into one-man cars. He estimates the cost of a car barn at Spokane street at $60,000.

THE PACIFIC CENTRAL DISTRICT

FOLSOM, CAL.—The Fair Oaks Irrigation District will, February 2, sell $20,000 bonds.

DAVIS, CAL.—Plans for a complete new water system, separate from any now in existence, are being prepared for this city by Engineer T. R. Galloway.

VALLEJO, CAL.—Ground will be broken about the middle of February for the construction of a $70,000 three-story structure for the Vallejo Electric Light and Power Company.

MARYSVILLE, CAL.—Marysville and Nevada Power and Water Company will, January 20, remove its offices from Marysville to Hobart Building, 582 Market Street, San Francisco.

LOS BANOS, CAL.—The city trustees decided to advertise for bids in the open market for the sale of the bond issue amounting to $103,000, the money to be expended on the water system.

MODESTO, CAL.—Council-Application has been made by the De Yoe addition for water extensions and the matter was referred to the city engineer to make the connections, which will require 1000 feet of 2-inch pipe.

OAKDALE, CAL.—The Oakdale irrigation district board is ready to build Melones reservoir, according to statements made by F. H. Lee, secretary of the Water Storage Development Association. Estimated cost of the reservoir is $1,690,000.

PORTERVILLE, CAL.—Geo. B. Sturgeon of San Francisco has been chosen for chief engineer of the construction to be started soon by the South Tule Independent Ditch Company, including a storage reservoir and a new distrib-

uting system through which to handle the water to which the irrigators are entitled from Tule river.

RICHMOND, CAL.—A vastly increased electric power has been made available through a "tie-in" accomplished recently by the Western States Gas and Electric Company, which serves Richmond, into the higher power line of the Pacific Gas and Electric Company.

The new line connects with the 60,000 volt line of the latter company in the San Pablo Valley. A camp has been established near San Pablo by the company, which has a number of men at work on the job. The completion of the work will require about ten days.

VALLEJO, CAL.—An allotment of $47,500 was received by the Public Works Department on Mare Island for the electrification of the causeway and the construction of a number of electrified spurs to be used in handling the transcontinental freight shortly to be brought to the navy yard by car barges from the lower bay.

WOODLAND, CAL.—Plans for the formation of a new irrigation district are to be contained in articles of incorporation which will be filed with the Secretary of State in a few days by members of the newly organized Capay Valley Ditch Company. Directors of the company are M. H. Stitt, B. F. Gibson, C. A. Fein; James Schaffer and S. Gladney. James Houx is secretary.

MANTECA, CAL.—Six financial houses bid for the $200,000 bond issue of the South San Joaquin irrigation district, but the Anglo-London and Paris National Bank of San Francisco offered the highest premium and received the entire award, at the meeting of the board, held to open and consider offers. The successful bank offered par and accrued interest, plus a premium of $4,084.

SAN FRANCISCO, CAL.—Contracts for the outlet system of the Hetch-Hetchy reservoir estimated to amount to $480,000, shortly will be let by the Board of Public Works. The first calls for six 47 x 90-in. steel slide gates, for which the estimated price is $120,000 and for which bids will be received March 3. The second will be for six 33 x 42-in. slide gates, mostly bronze, for which the estimated price is $130,000 and for which bids will be received March 24.

HANFORD, CAL.—President Hansen, Director A. H. Johnson and Secretary D. I. Drown of the Corcoran Irrigation District received sealed bids for the purchase of $600,000 of six per cent bonds. The block was awarded to Leroy T. Ryone & Co., of San Francisco, at a premium of $13,546.50. All construction bids were rejected as too high. A resolution was passed that the district should do the work with its own camps. Superintendent W. W. Atwater will have charge of construction.

BERKELEY, CAL.—Plans for the building of the first unit of the Pacific Port terminal on the Berkeley water front were filed recently with the city council by Attorney Stanley Smith, representing Rufus P. Jennings, promoter of the project, who now holds a lease on the water front property. Smith estimated that actual building operations would be started this year and that within the next five years at least $1,175,000 will be spent on land leased from the city. A railroad from the adjoining main line railroad will be built.

OAKDALE, CAL.—Oakdale has decided to increase her lighting system by about 20 per cent, and twenty new lights will be added at once. The Trustees have decided to greatly increase the street system. No increases have been made for four years, while $20,000 has been spent for other improvements in town. The Board also discussed the possibility of taking over the city system of lights, now owned by the Sierra and San Francisco Power Company. City Attorney Reeder declared, however, that the price put upon the system by the company at the rate hearing was prohibitive. There was also complaint on the part of the Board over the present service, the lights themselves being very poor, it was claimed.

AUBURN, CAL.—The Pacific Gas and Electric Company has announced extensive improvements soon will be under way on its irrigating system between Auburn and Newcastle and south and east of Newcastle toward Folsom. District Manager H. M. Cooper says the company will spend several hundred thousand dollars the coming year, and that it may take two years to complete the work. The tunnel through Adams Hill, just below the Wise power house, will be enlarged and the main ditch increased in size. A number of lateral ditches will also be run. The water will be used to irrigate a fast-increasing orchard planting in that section. Already a large force of men is at work erecting camps and boarding houses on the Auburn-Newcastle road.

THE PACIFIC SOUTHWEST

LOS ANGELES, CAL.—Fire demolished the Substation No. 44 of the Pacific Electric Railroad at Wilmington. Loss, $7,500.

MONROVIA, CAL.—Klusman & Elsea have been awarded a contract for construction of a 2,500,000-gallon reservoir for the enlarged water system, at $27,434, work to begin at once.

SAFFORD, ARIZ.—The San Carlos dam project is to be brought before the Government as one of the first units of construction after the enactment of the $250,000,000 reclamation bill.

LOS ANGELES, CAL.—The Board of Public Works has awarded a contract to the Portland Cement Company for 5,000 bbls. of cement for use at No. 2 Power Plant and an option secured for 5,000 bbls. additional.

LOS ANGELES, CAL.—The Los Angeles Chamber of Commerce has been informed that the company formed to operate the International Dehydrator has placed an order for $600,000 worth of new machinery, for a plant to be located in or near Los Angeles.

PALMDALE, CAL.—Palmdale and Little Rock bond issues for irrigation improvements carried at a recent election. Palmdale voted a bond issue of $382,000 and Little Rock $200,000. The two communities will combine in the construction of a dam in Little Rock Creek.

PHOENIX, ARIZ.—A contract has been entered into with the United States Reclamation Service in regard to the completion of the survey for its San Carlos dam project. W. W. Schneicht, the project manager at Yuma, represented the Government at the meeting of the State Land Board.

LOS ANGELES, CAL.—The first step toward the electrification of all the steam roads on the Coast was taken here with the announcement of a plan to install electric locomotives for switching service in the Los Angeles terminals of the Santa Fe, Salt Lake and Southern Pacific. Poles have already been erected on Alameda street to carry the high-voltage wires.

SANTA BARBARA, CAL.—In view of the completion of the dam, Montecito water users are speeding up their plans for buying water wholesale from the city. A new company has been organized as the Mountain Drive Mutual Water Company. Articles of incorporation will be filed at once. Plans for the proposed reservoir are under consideration. Montecito people must lay down their own high line from the city's surge chamber and install their own distributing system.

THE INTER-MOUNTAIN DISTRICT

DUBOIS, IDAHO.—The city council has decided on a rate of 13c. per kilowatt-hour for lighting service in this community.

DOWNEY, IDA.—This city is to have a new street lighting system to be installed in the early spring, to consist of sixteen 400-candle-power Type "C" units.

SANTAQUIN, UTAH.—This town is the latest in this section of the country to consider the installation of "White Way" lighting for its business district. Prominent business men of the community are very much in favor of the plan and expect to have the installation made.

BUTTE, MONT.—Attorney-General S. C. Ford of Montana has ruled that irrigation bonds take precedence over state farm loans when both are liens against the same district, under state auspices.

BLACKFOOT, IDA.—The Utah Power & Light Company has connected its Grace plant with the substation of the Idaho Power Company in this city, giving double the source and an increase of current supply.

SALT LAKE CITY, UTAH.—Utah Power & Light Company has granted an increase in salaries affecting all employes receiving less than $200 per month, which increases the total annual payroll by more than $125,000.

PUEBLO, COLO.—The C. F. & I. Company's steel plant has been officially opened in practically all departments and will be in complete operation by January 1. The Arkansas Valley Railway, Light & Power Company has resumed street railway service to the steel district which had been discontinued on account of the strike.

HELENA, MONT.—A hydroelectric plant near Rimini to generate power for operating the street lighting system of Helena is being considered by the city council, it was revealed at a recent meeting. With wood pipes the project will cost $125,000, according to figures submitted; concrete pipes, $175,000, and steel pipes, $225,000. This question also will be left to the voters, it is understood.

PRICE, UTAH.—The Eastern Utah Electric Company has been incorporated in this city to take over the present electric business of W. C. Broeker, which has grown to such proportions that it requires more capital and a larger concern to take care of the demand for supplies. The company will wholesale electric supplies and appliances in the eastern part of Utah, from Vernal to Monticello. They also expect to build up a considerable business in Emery county.

POCATELLO, IDA.—The Big Springs project for supplying water to towns along the Snake river was discouraged by Engineers E. S. Anderson and Virgil Samms, who told the recent convention of mayors that the cost would be excessive. The plan would have necessitated the construction of a 36-inch conduit 143 miles long, and the cost if built of wood was estimated at $10,500,000; if of iron, $15,000,000; or reinforced concrete, $50,000,000. A further reason for discouragement is the fact that all of the fall is in the first 30 miles.

LEWISTON, IDA.—This place has been included in the plan of the Pacific Power & Light Company for extensive improvements and an engineer and draftsman were recently on the ground preparing the plans and specifications. Materials will begin arriving at an early date. The Pacific Power & Light Company operates the Lewiston gas plant and the appropriation for the Lewiston improvements was secured by Manager R. J. Jenks at a recent conference in Portland. The company will this year spend more than $2,000,000 in improvements and betterments to its plants in the Northwest and several thousand dollars will be expended here.

BISHOP, CAL.—The Nevada California Power Company is planning to spend during 1920 around $400,000 in development work on Lee Vining Creek in Mono county. This development will carry the work far enough along so that a power plant can be completed in 1921. The dam at Saddlebag Lake will be built to a height of 30 feet, which will mean an expenditure of over $100,000, while 2,223 feet of flow line tunnel and the standpipe raise will add $96,800. The balance of the work will consist of the foundation work on a diversion dam at Rhinedollar Lake, excavation for power house and foundations, installation of a tram, saw mill, camp buildings and equipment. The completion of this plant will add 15,000 horsepower to the system.

Speaking of truth, in accordance with the law which requires candidates for office to file a report of all expenditures, one of them turned in the following absolutely truthful report of what it cost him to get elected:

"Lost 1,349 hours' sleep thinking about the election.
"Lost two front teeth and a lot of hair in a personal encounter with an opponent.
"Donated one beef, four shoats and five sheep to country barbecues.
"Gave away two pairs of suspenders, four calico dresses, $5 in cash and fifteen baby rattlers.
"Kissed 126 babies.
"Put up four stoves.
"Kindled fourteen fires.
"Walked 4,076 miles.
"Shook hands with 5,908 people.
"Told 10,101 lies and talked enough to make in print 1,000 volumes; attended sixteen revivals and was baptized four different times by immersion and twice some other way.
"Contributed $50 to foreign missions and made love to nine widows—five grass, four sod.
"Hugged forty-nine old maids.
"Got dog bit thirty-nine times and was elected by 353 majority."

* * *

LITTLE LIMERICKS FOR THE FEEBLE MINDED

1. There once was a fellow named Botts
Who thought he could conjure with watts:
He mixed up the wire—
The house caught on fire
And burned up a couple of lots

2. A curious lady named Gamp
Who wanted to look at an amp,
Dissected her meter
Not dreaming 'twould treat her
The same as a wired-up lamp.

3. There once was a fellow named Bank,
Who went to his gasoline tank
And lighted a match ——
He heard the first scratch
But thereafter his mind was a blank.

4. There once was a lady named Rich
Who looked at a high voltage switch;
She thought she'd find out
What it all was about
And found herself out in a ditch.

P. S.—In order that nobody may be blamed for these, we hasten to confess that they were composed by a member of our staff during a slight mental lapse. We found them in the waste basket, and anybody who wishes we had left them there can tear out the page and put them back again.

* * *

Labor-saving devices are all very well, but when the millennium comes who is going to have the energy to work the devices?

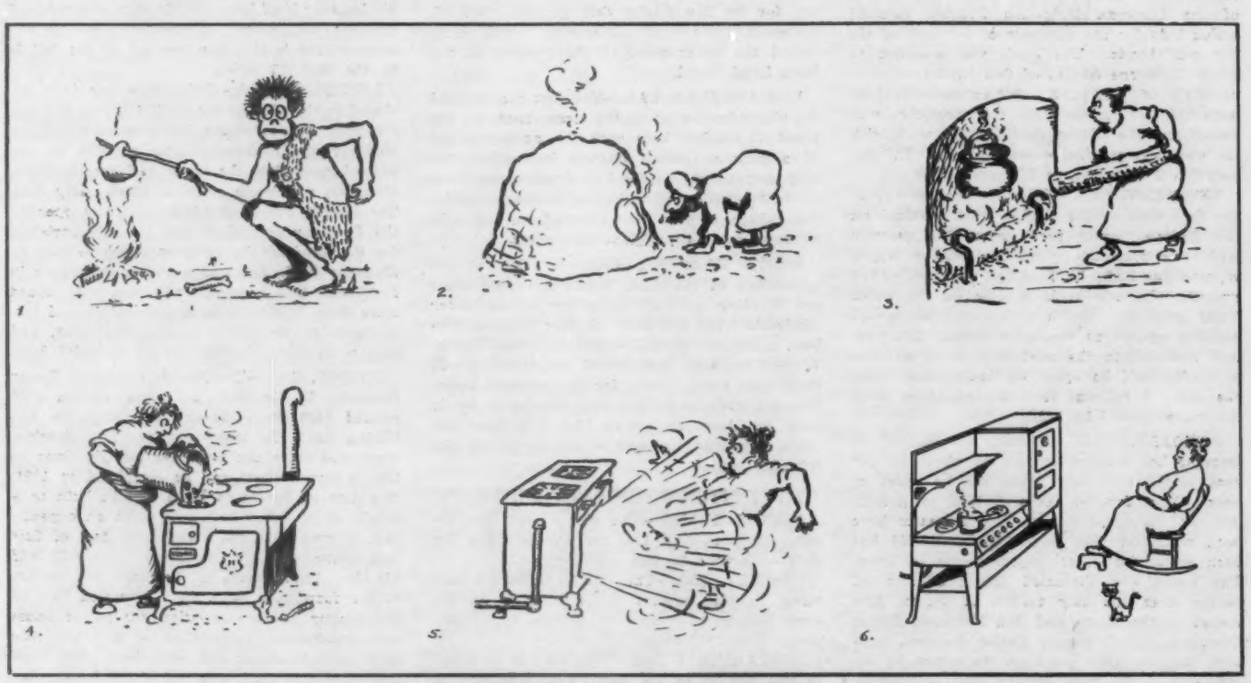
Lazy Lorenzo and Dog-Tired Dick were discussing something they knew little about—work.

"I think," said Lazy Lorenzo, "that if they did away with work altogether it'd put an end to these 'ere strikes."

"Yus," said Dog-Tired Dick. "That'll be the time when everything's done by electricity. Only got to press a button and the job's done."

A slow horror dawned in Lazy Lorenzo's eyes.

"That won't do!" he said emphatically. "Who's a-goin' to press the button?"



THE EVOLUTION OF ELECTRIC COOKERY

as displayed by H. C. Rice, of the Southern California Edison Company, in a recent address